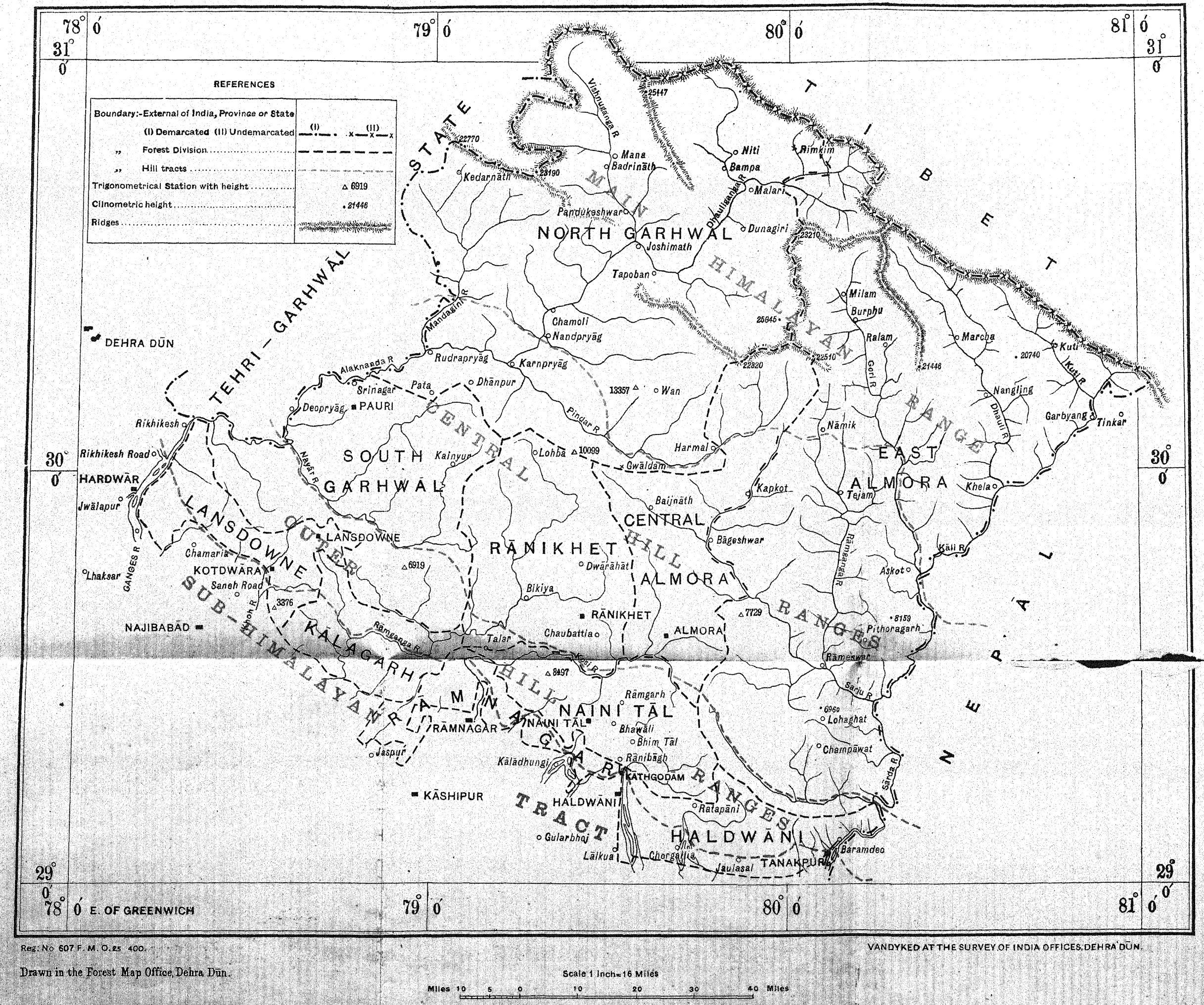


MAP OF KUMAUN SHOWING FOREST DIVISIONS AS THEY STOOD IN JANUARY 1924 AND ILLUSTRATING THE EXTENT OF THE PRINCIPAL SUBDIVISIONS USED IN THE TEXT.





A
FOREST FLORA
FOR KUMAON

BY
A. E. OSMASTON, F.L.S.,
Officiating Conservator of Forests



ALLAHABAD:
Superintendent, Government Press, United Provinces

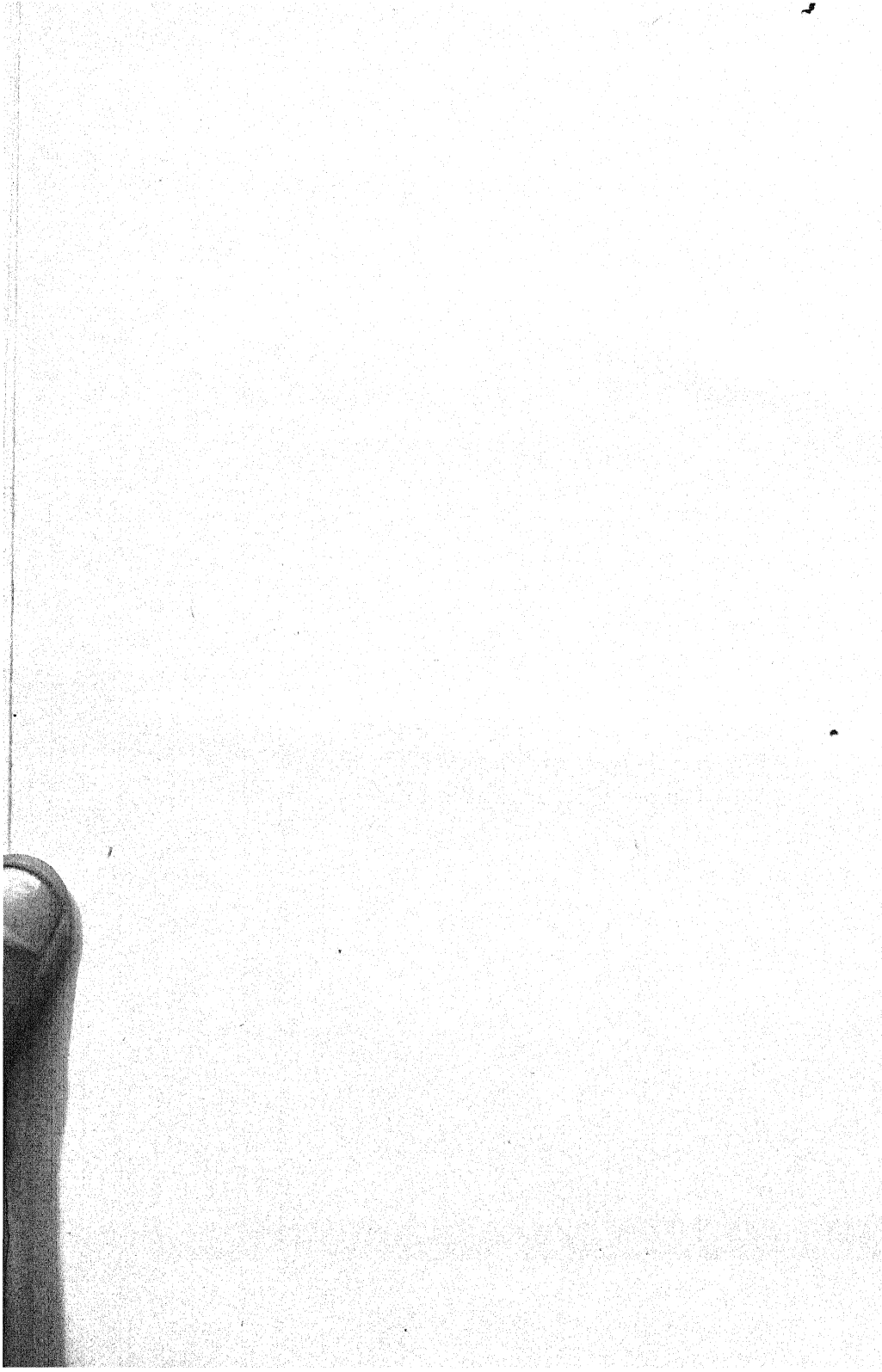
1927

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Flower in the crannied wall,
I pluck you out of the crannies ;—
Hold you here, root and all, in my hand,
Little flower,—but if I could understand
What you are, root and all, and all in all,
I should know what God and man is.

Tennyson.



PREFACE.

IN February, 1913 I received information from the Government of the United Provinces that I had been selected to compile a descriptive list for the area embraced by the Kumaon Civil Division. The list was published in 1922, but the information included in this work was not so comprehensive as was originally intended, and in consequence it was eventually decided that I should aim at producing a small local forest flora for the same area. The preparation of this flora may therefore be said to have been spread over a period of 13 years. During the last of these years my work has enabled me to pay brief visits to parts of the submontane divisions, but as the manuscript had already been sent to press I could only make use of my added information to a limited extent. Of the remaining 12 years, seven were spent in the Garhwal hills, two on leave, and for three I was working as Instructor at the Dehra Dun Forest College where my duties included short tours in the Ramnagar, Naini Tal and Ranikhet Forest Divisions. It will thus be seen that whereas I had ample opportunities for studying most of the hill species, I was not equally fortunate with regard to those of the submontane tracts. Whilst on leave I was able to spend a short time at Kew, but the time available was only sufficient to enable me to investigate doubtful points which had arisen whilst I was working at Dehra Dun and I was unable to do more than this.

I have compiled a list of the principal works consulted, but Parker's *Funjab Flora* is that which above all others has been my mainstay. From this flora I have abstracted more freely than from any other, and it is scarcely too much to state that the present work could not have been completed without it. Next after Parker's *Flora* I have been mostly indebted to Duthie's, Haines' and Gamble's *Floras*, and here again I can hardly overstate my indebtedness. I am also pleased to be able to place on record my gratitude to the many who have helped me in other ways. Mr. R. N. Parker, the present Forest Botanist at the Forest Research Institute, Dehra Dun, has been unstinting in his personal assistance and has also given me every possible help whilst working in the Dehra Dun Herbarium, and here I must also mention the kindly help given me by the Curator, Mr. B. L. Gupta. Scarcely less am I indebted to Mr. R. S. Hole, C.I.B., who preceded Mr. Parker as Forest Botanist; also Messrs. H. G. Champion and W. J. Lambert who supplied me with many valuable notes and whose names I have frequently quoted in the text. My thanks are also due to the Director and Herbarium staff of the Royal Botanic Gardens, Kew, for every

facility given me whilst working in the Kew Herbarium, and finally I cannot omit to mention the helpful assistance and advice kindly given on many occasions by my friend the late Mr. J. S. Gamble, C.I.E.

In conclusion I may say that the compilation of this flora, though devoid of any pretensions, has proved a labour of absorbing interest, and when my spirits have flagged I have received much encouragement from the following lines by Goethe—

Art little? Do thy little well :

And for thy comfort know

The great can do their greatest work

No better than just so.

If it may be said that I have done my little well, that is all I ask.

March , 1926.

A. E. OSMASTON.

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INTRODUCTION.

THE title of this flora gives the area dealt with as Kumaon, by which is meant the Kumaon Civil Division. Actually the area does not include a narrow strip of plains country lying to the south of the submontane reserved forests, though included within the Kumaon Civil Division, since the boundaries of the reserved forests have been accepted as being a more convenient limit for our purpose; the flora being primarily intended for forest officers. This can be seen on the map.

I have included as far as possible such trees, shrubs and woody climbers as are indigenous, besides a few which are not indigenous but which are more or less completely naturalised. No herbs have been described, though doubtless opinion will differ as to whether I have drawn a correct line in every case between shrubs and herbs. As a rule those plants possessing an insignificant perennial and woody portion to the stem but with tall and robust herbaceous portions have been included, as for instance *Strobilanthes atropurpureus*, Nees.; whilst others with weak and inconspicuous stems have been excluded, even though the root-stock is perennial and more or less woody such as *Crotalaria alata*, Ham, and *Argyrolobium flaccidum*, Jaub. and Spach.

The total number of species described is 816 distributed over 94 families, and if species which are sometimes herbaceous are excluded, there still remain 290 trees, 321 shrubs and 112 climbers. All these are indigenous to the area excepting 12 trees and 8 shrubs, as follows:—

Malvastrum tricuspidatum, A. Gray, *Azadirachta indica*, A. Juss., *Melia Azedarach*, Linn., *Sapindus Mukorossi*, Gaertn., *Tamarindus indica*, Linn., *Acacia arabica*, Willd., *Acacia Farnesiana*, Willd., *Cassia laevigata*, Willd., *Mimosa pudica*, Linn., *Prunus persica*, Stokes, *Psidium Guyava*, Linn., *Punica Granatum*, Linn., *Opuntia monacantha*, Haw., *Lantana Camara*, Linn., *Clerodendron fragrans*, R. Br., *Jatropha Curcas*, Linn., *Sapium sebiferum*, Roxb., *Ricinus communis*, Linn., *Morus indica*, Linn., *Dendrocalamus Hamiltonii*, Nees. and Arn.

It is of interest to compare in a brief statistical manner the forest flora of Kumaon with that of the Punjab as depicted in Parker's Forest Flora. I have described for Kumaon 269 species which have not been described for the Punjab; these include 93 trees, 130 shrubs and 46 climbers, all of which are indigenous to Kumaon except 2 trees and 2 shrubs. In this connection I have considered as undescribed those species in Parker's Flora which are only briefly described in small type.

The above figures do not give an absolutely accurate comparison of the two floras, because in a few cases I have described species which are sometimes herbaceous or semi-herbaceous, whereas Parker has for this reason omitted to describe them, although they occur in the Punjab; such cases, however, are not very numerous. It is further of interest to note that the following are those genera in which I have described for Kumaon 4 or more species not described for the Punjab, i.e., *Berberis* 6, *Vitis* 8, *Desmodium* 5, *Caragana* 4, *Flemingia* 4, *Rubus* 6, *Symplocos* 5, *Polygonum* 7, *Ficus* 6 and *Smilax* 5. These figures indicate true additions to the natural flora of the Punjab, except in the case of one *Desmodium* and several of the *Polygonums*.

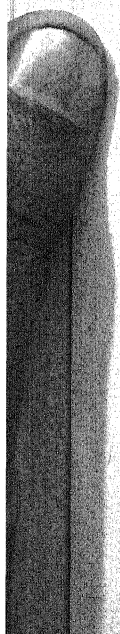
The family and generic descriptions are intended to be complete for all known species, whether Indian or not; the generic and specific keys and the synopsis of the genera have however been framed largely or exclusively with reference to the plants described, as by this means the keys can be made comparatively simple.

In the descriptions of the species I have attempted to indicate by figures the limits of growth normally attained by each species. These figures are only intended to convey a better idea of the general size of the tree or shrub than can be given by mere descriptive terms, and it must not be supposed that they represent the maximum dimensions possible under any combination of circumstances, nor should they be taken as applicable to areas outside our own. Descriptions of the blaze have also been given and here a little explanation is required. Forest officers will naturally know what is meant by blaze, but for the benefit of those who may not know, and in case my interpretation of its meaning may be different from that accepted by others, I may state that the blaze refers to the thickness, texture and colour of the bark as exhibited by a slanting cut made with a penknife. In my descriptions I have taken these characteristics separately; the thickness I have recorded in inches or decimals of an inch with no mention of any word denoting thickness (which is to be understood), and it should be carefully noted that these figures include the dead outer tissue as well as the living inner tissues; the texture and colour on the other hand refer only to the living tissues unless expressly stated to the contrary. My descriptions of the blaze only refer to mature or nearly mature stems as young stems have usually quite different blazes to old ones. This variability in the blaze depending on the age of the tree is undoubtedly a factor which tends to minimise the value of such data, and for this reason too much reliance must not be placed on these characters. The figs are an extreme case in point, and owing to the peculiar and rapid development of the stem, these may exhibit several different types of blaze from cuts made in as many different parts of the same trunk.

In the epiphytic figs with aerial roots of varying age and size which anastomose to form a single trunk this variability is most conspicuous. For these and other reasons the descriptions I have given may give rise to criticism, nevertheless the blaze is often an extremely useful field character, and it is hoped that the descriptions will be found to justify their inclusion. As regards their accuracy I must frankly admit that many of them are based on somewhat meagre data, since I have had to rely entirely on my own field notes, and owing to the variability noted above it is necessary to make many observations on each species before a completely accurate description can be given. The description of the outside appearance of the bark is presumed to be that of a mature tree unless otherwise stated in the text.

It is, I think, as well to explain here the meanings which I have ascribed to the terms sinuate and undulate. Two conditions exist, firstly, that in which the leaf-margin is not quite entire but has a wavy in and out contour, the plane of the leaf remaining constant; this condition I have described as sinuate. The second condition is that in which the leaf-margin is entire but the marginal area of the leaf has a wavy up and down contour resulting in the plane of the leaf becoming inconstant; this condition I have described as undulate. It is sincerely hoped that in adopting this course I have not contravened any recognized botanical distinctions, but in studying other floras I came to the conclusion that the authors were not always in agreement in this matter, and a reference to the glossaries of botanical terms at my disposal did not help to elucidate the matter.

Finally I wish to explain that the period of fruiting given in the descriptions of species is intended to represent those months during which ripe fruit may be found; the period occupied in ripening the fruit is not ordinarily included.



GENERAL DESCRIPTION OF THE CLIMATE, GEOLOGY AND FOREST VEGETATION.

Climate and Geology.

In this brief account I shall divide the whole tract up into five belts of country running approximately north-west and south-east parallel to the Himalayas themselves. The selection of these belts is based primarily on variations in the annual precipitation both as regards the total amount which falls each year and also with reference to the relative percentages of the total which fall during the monsoon and winter months respectively.

THE FIRST REGIONAL BELT.

This comprises the Tarai and Bhabar which are jointly referred to in this flora as the subhimalayan tract. By the Bhabar is understood that waterless area which extends along the foot of the hills and is composed of comparatively recent beds of boulders, gravels and silt brought down by the Himalayan streams. The deposits being of great depth and extremely porous the water table is found during the hot weather months at a considerable depth below the surface of the ground and, except during the height of the monsoon, all the lesser water-courses tend to dry up completely. This Bhabar formation varies in width from practically nothing, as for instance at Jaulasal, up to about 15 miles, the widest portions lying on either side of the principal rivers. Though comparatively flat, there is distinct terracing apparent throughout these deposits except where they occur as Duns. The best known Duns within our area are the Patli, Kotah and Khaldhunga. Such Duns do not occur to the east of Haldwani as their origin was apparently coincident with the upheaval of the Siwalik hills, and these do not give rise to the same broad belt of low hills which is so characteristic a feature of their presence further west. The Siwaliks consist of Tertiary conglomerates and sandstones. The former is a rock of variable hardness often indurated with lime, whilst the sandstones are usually composed of coarse sands with occasional beds of clay. The Siwalik hills are a prominent feature in the Ramnagar and Kalagarh Divisions where they form a belt of low hills 5—10 miles broad, intersected in all directions by numerous ravines. The Tarai lies immediately south of the Bhabar and is a level belt of country characterised by numerous springs and swamps with a subsoil of sandy alluvium. The rainfall of this subhimalayan tract varies between 50 and 70 inches, of which about 7 per cent. falls as winter rains during January, February and March,

whilst about 80 per cent. falls from June to September and is directly due to the monsoon currents. From November to March heavy dews occur at night time, so heavy in fact that on cool northern slopes and in enclosed valleys the whole undergrowth is dripping with moisture till late in the day. Such dews are most conspicuous east of Haldwani and more especially in the Tarai. From April till the break of the rains in June the temperature is very high, though the cool "dadu" which blows down the principal valleys at night exerts a modifying influence wherever the larger rivers leave the hills. In low-lying areas several degrees of frost are usually registered at night during part of December or January, the lowest temperatures being recorded in enclosed areas like the Patli Dun.

THE SECOND REGIONAL BELT.

This stretches from the base of the foot-hills in the region of such places as Kotdwara, Kalagarh and Kathgodam to the crest of the outermost range of hills as exemplified by Naini Tal. The hills rise from an elevation of 1,000 to 2,000 feet at their base to heights varying from 4,000 to 8,500 feet at their summit. They are intersected by numerous watercourses both large and small, and the general aspect of the whole is south. The rocks of which they are composed are mostly similar to those already described as constituting the low Siwalik hills which form a southerly extension at their base. Generally speaking only upper portions of the larger ridges are composed of the ancient Pre-Cambrian sediments which characterise the area to be described next. Unstable slates and shales belonging to this latter group have produced the steep slopes which are so conspicuous a feature in the vicinity of Naini Tal.

The region we are now considering possesses the heaviest average rainfall of any portion of the Kumaon Division. It varies between 70 and 120 inches in the year, of which about 7 per cent. falls during the winter and 80 per cent. during the monsoon. Frosts are rarely severe below 5,000 feet elevation, and the heavy dews so characteristic of the submontane areas are no longer of any consequence. The summer heat from April to June is however considerable owing to the predominant southern aspect and the proximity to the plains. On steep south aspects the resulting dryness of the soil at this season is a factor of great importance.

THE THIRD REGIONAL BELT.

We now come to the broad belt of mountainous country stretching from the crest of the outermost range to the main line of Himalayan peaks represented by Badrinath, Trisul and others. The valleys of the Sarda, Kosi, Ramganga and Ganges rivers remain at a low level for

considerable distances within the hills so that the Ganges for instance at its junction with the Pindar is still below 2,500 feet elevation. The main intervening ridges vary as a rule between 5,000 and 10,000 feet elevation. The rocks of which these hills are composed belong almost exclusively to the ancient Purana group which are Pre-Cambrian sedimentary deposits composed largely of slates, limestones and quartzites. A hard quartzite and a soft mica schist are met with over extensive areas, whilst bands of hard limestone form some of the most characteristic features of the country. One such band starting from the Sarju between Pandrapali and Chirpatkot extends north-west through Harmal and Chaur in the Pindar valley to Pipalkoti in the valley of the Alakhnanda, the outcrop in the Almora district having an average width of about 12 miles. There are many other outcrops of limestone, but none so extensive as this. Granites, gneisses and other crystalline rocks form the main axis of the great Himalayan range and, in Garhwal, they are found almost exclusively to the north of the district. In the Almora district they have a far wider distribution and are not uncommonly met with in the central ranges, as for instance at Airadeo.

As might be expected the annual precipitation within this broad belt of mountainous country varies considerably, the limits being about 40 and 80 inches. Some 15 per cent. of this falls partly as snow and partly as rain during the winter, whilst 75 per cent. falls during the monsoon. The heaviest rain occurs along the southern spurs of the main Himalayan range and in the vicinity of the more prominent central ranges such as Dudatoli in the Garhwal district and Badkot and Binsar in the Almora district, whilst the lowest rainfalls are recorded from the portions of the central ranges where the surrounding hills are low, as for instance Srinagar in the Garhwal district and Almora in the Almora district. The months of November and December are dry, but from January to April is a period of unsettled weather and frequent storms which centre round the principal mountain heights. At this time of the year snow may be expected down to 5,000 feet and in exceptionally severe winters it may fall as low as 3,500 feet elevation, but on southern aspects it rapidly melts below about 9,000 feet. During May and June the temperature in the low valleys is surprisingly high, and these same valleys are frequently filled with damp cold mist in the early mornings during January and February.

THE FOURTH REGIONAL BELT.

On passing north of the main Himalayan range the amount of precipitation decreases abruptly and the inner forest-clad valleys of this tract receive at most 10—40 inches during the year, of which at least 30 per cent. falls as snow during the winter and about 50 per cent. as rain during the monsoon. The winter is long and severe even at the

lowest elevations, and the summer is generally mild. The rocks here are similar to those described for the area south of the line of high peaks.

THE FIFTH REGIONAL BELT.

Finally we come to a narrow belt of country bordering Tibet where the annual precipitation is less than 10 inches and probably 50 per cent. or more of this falls as snow during the winter months. The climate is extremely rigorous and is more or less identical with that existing in Tibet itself. The effect of insolation during the day time is extreme and the air is excessively dry. A strong south wind prevails throughout the day time and adds to the general effect produced by other dessicating agents. The rocks are mainly sedimentary, ranging in age from the Cambrian to the Tertiary epochs. The whole surface of the country lies above 10,000 feet and trees of all species are entirely absent.

The Forest Vegetation.

The forests themselves I propose to sub-divide as follows:—

I.—Forests lying south of the line of the main Himalayan peaks (namely Kedarnath, Trisul and Nandakot) where the annual precipitation varies between 40 and 120 inches.

1.—Forests of the Tarai and Bhabar and throughout the hills up to about 6,000 feet on south aspects and 5,000 feet on north aspects, namely where the climate is tropical or subtropical and the mean minimum temperature does not fall below 70° F.

(a) Forests of broad-leaved species up to about 4,000 feet elevation where frosts are absent or light and snow practically unknown.

A.

(i) Deciduous riverain forests of *sissu*, *khair* and *Holoptelia integrifolia* which follow the banks of the principal rivers up to about 2,000 feet elevation.

B.

(ii) Deciduous forest of miscellaneous species in the Bhabar.

C.

(iii) Subdeciduous forests of *sal* in the subhimalayan tract and outermost hill ranges up to about 2,500 feet elevation.

D.

(iv) Evergreen forests of *Eugenia jambolana* and other miscellaneous species in the subhimalayan tract and along the banks of streams in the outer ranges up to about 2,500 feet elevation.

E. (v) Deciduous forests of *Anogeissus* and other miscellaneous species in the central and outer hill ranges up to about 4,000 feet elevation.

F. (b) Forests of *chir* extending between 3,000 and 7,000 feet elevation, where frosts are often severe and snow frequently falls.

2. Oak and low-level silver fir forests extending throughout the hills between 5,000 and 11,000 feet elevation namely where the climate is temperate and the mean maximum temperature does not rise above 70° F.

G. (i) *Banj* oak forests between 6,000 and 8,000 feet elevation.

H. (ii) *Moru* oak forests between 7,000 and 8,000 feet.

J. (iii) *Karshu* oak forests between 7,500 and 11,000 feet.

K. (iv) Low-level silver fir forests between 8,000 and 9,500 feet.

II.—Forests lying north of the line of the main Himalayan peaks, where the annual precipitation varies between 10 and 40 inches.

L. (i) Blue pine forests between 6,000 and 12,000 feet elevation.

M. (ii) Spruce forests between 7,000 and 10,000 feet.

N. (iii) Cypress forests between 6,500 and 9,500 feet.

O. (iv) Deodar forests between 8,000 and 10,000 feet.

P. (v) Forests of mixed hardwoods between 7,000 and 9,000 feet.

Q. (vi) High-level birch forests between 9,500 and 12,000 feet.

R. (vii) High-level silver fir forests between 9,500 and 12,500 feet.

S. (viii) Alpine bushland between 10,000 and 13,500 feet.

III.—Bushland lying within a narrow belt of country bordering Tibet where the annual precipitation is below 10 inches.

T. (i) Riverside bushland between 11,000 and 14,000 feet elevation.

V. (ii) Hillside bushland between 9,000 and 15,000 feet.

Each of these forest communities bearing a separate letter will now be discussed in further detail.

A. DECIDUOUS RIVERAIN FORESTS OF *sissu* (*Dalbergia sissoo*),
khair (*Acacia Catechu*) AND *Holoptelea integrifolia*.

Both *sissu* and *khair* are pioneers on bare sandy and gravelly deposits bordering the rivers and streams of the subhimalayan tract where extensive forests of these species are to be found. Such newly formed soils may be colonised in the first instance by grasses such as *Saccharum spontaneum* and *Saccharum Munja* or by shrubs such as *Orthanthera viminea* and *Tamarix dioica*, but *sissu* and *khair* are the only two species which form natural tree forest direct without the intervention of any preparatory types of vegetation. In the case of both these species the seed is mainly disseminated by the agency of water, but whereas *sissu* has become so specialised in its requirements that it rarely reproduces itself except where the seed is brought down by flood water in the open, *khair* is less exacting and reproduces itself sporadically beyond the reach of floods in open forest or grass land. One of the characteristic features of these forests is the absence of other tree species and though *sissu* and *khair* are often found mixed, this too is rather the exception than the rule. That they are not more frequently found mixed is probably due to the heavier seeds of the *khair* being deposited where there is too much current for the lighter fruits of the *sissu* to come to rest.*

When occurring in mixed crops the *sissu* soon outstrips the *khair* owing to its more rapid and greater height growth and a two-storied canopy is usually the result. Whilst the crops are young the soil may be almost bare or a more or less dense growth of *Saccharum spontaneum*, *S. Munja*, *Aristida cyanantha* and other grasses may be present. As the forest grows older the grasses are usually replaced by a dense growth of *Pogostemon plectranthoides*, *Adhatoda Vasica* or *Murraya Koenigii* and this in turn may under favourable circumstances be replaced by a dense growth of *Holoptelea integrifolia*. *Khair* and *sissu* crops are, owing to their position, frequently washed away. Here and there however the land surface becomes permanent and is gradually elevated by the addition of fresh deposits. As the surface rises above the level of floods the forest will slowly but surely change to one composed of miscellaneous species in which *khair* and *Holoptelea* may constitute varying proportions of the crop.

B. DECIDUOUS MISCELLANEOUS FORESTS OF THE BHABAR.

As outlined above the strictly riverain types of forest which escape being washed away by floods will slowly undergo great changes and these will in most cases result in a deciduous type of forest composed of many different species. Such changes in the composition of the

* Vide Haines' Botany of Bihar and Orissa, Part I.

forest will be accompanied by corresponding changes in the land amongst which the most important is the raising of the surface above the normal level of floods. At the same time there will be considerable improvement of the soil, the upper layers of which will be enriched by the addition of humus. It is thus not uncommon to find the riverain forests flanked by miscellaneous forests, the latter occurring on distinctly raised terraces or plateaux. The plateaux tend to become more pronounced the nearer they are to the base of the outer hills and they constitute the typical Bhabar deposits already described. As a result of their composition and origin these deposits are characterised by a high degree of porosity combined with a deep water level, and this insufficiency of water is reflected in the deciduous nature of the forest. Other factors which have had considerable influence on the development and composition of these forests are grazing, lopping and burning. Though generally unsuited to habitation throughout the year these tracts have from time immemorial been resorted to by graziers during the winter months. Large numbers of Kumaonis also migrate each year from the neighbouring hills and carry on temporary cold weather cultivation in the Bhabar. This is especially the case in the Haldwani Division. Man has therefore exerted a considerable influence on the forests, and the natural density is often much reduced whilst in some cases forest has reverted to grassland in which *Andropogon muricatus* is not infrequently the dominant species.

Amongst trees there is no single species which ever forms pure forest of any extent and in most cases the forest is completely mixed. The chief characteristic of all the common trees is their leafless condition during the hot weather. *Mallotus philippinensis* is a notable exception, but this tree is more often completely dominated and should rather be classed with the other gregarious undershrubs such as *Adhatoda Vasica*, *Dendrocalamus strictus* and *Clerodendron infortunatum* which are also evergreen. The commonest trees in these forests are *Bombax malabaricum*, *Adina cordifolia*, *Lagerstrœmia parviflora*, *Holarrhena antidysenterica*, *Cassia Fistula*, *Lannea grandis*, *Garuga pinnata*, *Randia longispina* and *Zizyphus xylopyra*, the first two often towering head and shoulders above all the other species. In the transitional stages between the true riverain and the miscellaneous it is often found that *Holoptelea integrifolia*, *Adina cordifolia*, *Moringa oleifera* and *Wrightia tomentosa* are the first to appear. Some typical shrubs of the miscellaneous forests are—*Zizyphus jujuba*, *Helicteres Isora*, *Urena lobata* and *Sida veronicaefolia*.

C. SUBDECIDUOUS FORESTS OF *sal* (*Shorea robusta*).

Sal forms extensive forests and is highly gregarious. Where other factors are favourable the upper limit of *sal* is probably regulated to a

great extent by frost. In excessively dry localities, such as many due south aspects, it gives way to more xerophytic species. Whilst in localities with any tendency to waterlogging it is unable to compete with ever-green species. Within these limits *sal* occupies soils possessing widely differing characteristics which makes it possible to distinguish several different types of forest. For the purposes of comparative description I shall follow Messrs. E. A. Symthies and S. H. Howard* in grouping the different types of forest under three main heads namely "Hill *sal*," "Bhabar *sal*" and "Tarai and plains *sal*." The true plains *sal*, as distinct from tarai *sal*, is practically if not entirely absent from our area, but the two subtypes are very similar. Such description as I have given refers to *sal* in the tarai.

The following table has been prepared to indicate approximately in which of the three main types the commonest trees and larger shrubs are typical (T), or just present (P), or generally rare or absent (A).

Trees.				Hill.	Bhabar.	Tarai.
<i>Anogeissus latifolia</i>	...	...	...	T	P	A
<i>Ougeinia dalbergioides</i>	...	...	...	T	P	A
<i>Buchanania latifolia</i>	...	...	...	T	A	A
<i>Semecarpus anacardium</i>	...	...	...	T	P	A
<i>Randia longispina</i>	...	...	...	A	T	A
<i>Eugenia jambolana</i>	...	...	...	P	T	T
<i>Lagerstrœmia parviflora</i>	...	...	...	P	T	T
<i>Mallotus philippinensis</i>	...	...	...	A	T	T
<i>Terminalia tomentosa</i>	...	...	...	P	P	T
<i>Holarrhena antidysenterica</i>	...	...	...	A	T	T
Shrubs.						
<i>Dendrocalamus strictus</i>	...	...	...	T	P	A
<i>Colebrookia oppositifolia</i>	...	...	...	T	A	A
<i>Clerodendron infortunatum</i>	...	...	...	A	T	T
<i>Millettia auriculata</i> [†]	P	T	P
<i>Flemingia semialata</i>	...	...	...	A	T	A
<i>Inula Cappa</i>	...	...	...	T	A	A

* Indian Forest Records, volume X, part III.

† As a shrub.

This table shows that the hill type is very distinct since it does not contain a single typical species which is also typical of other types. It also shows that the Tarai and Bhabar types are not so distinct from each other and that many species are typical of both. Grasses appear in abundance in all types of *sal* forest where sufficient light reaches the ground. Three of the commonest species are *Anthistiria gigantea*, *Saccharum Narenga* and *Imperata arundinacea*. These often form dense patches of grass wherever the tree canopy is broken, but in such cases there is a continual struggle between grasses and trees or shrubs (such as *Mallotus* and *Callicarpa macrophylla*) for the possession of the ground. In most *sal* forests of whatever type, *sal* comprises 80 to 90 per cent. of the dominant tree species and tends to form a dense canopy. That the virgin *sal* forests contained a much higher percentage of miscellaneous species than our present forests, cannot be doubted. Large sums are annually spent in eliminating all such comparatively worthless species and the balance of nature is now heavily weighted in favour of *sal* and a few other valuable timbers. Not only so, but certain species with limited coppicing powers such as *Buchanania latifolia* and *Lannea grandis* are heavily handicapped in the struggle for existence. *Sal* is itself subdeciduous and all the commonest tree associates are deciduous with the exception of *Eugenia jambolana* and *Mallotus philippinensis*. Amongst shrubs there is considerable variation though two of the commonest, *Clerodendron infortunatum* and *Colebrookia oppositifolia*, are evergreen.

Hill sal.

In the hills *sal* does not extend beyond the outer ranges even though the main river valleys of the central ranges are well below the maximum elevation at which this species will grow. In the outer hills it is commonly found up to about 2,500 feet elevation on south aspects and 3,500 on north. Within these altitudinal limits the driest south slopes are usually occupied by *Anogeissus latifolia* and other deciduous species whilst along shady ravines on north aspects the *sal* gives place to a mixed evergreen and deciduous forest in which *Terminalia tomentosa*, *Cedrela Toona* and *Eugenia jambolana* are seldom absent. The underlying rocks are almost invariably sandrock or Nahan sandstone. Owing to shallowness and dryness of the soil the growth of *sal* in the hills is poor. A notable feature of many hill forests is the prevalence of the climber *Bauhinia Vahlii*. In the Kalagarh Division *sal* occurs on a comparatively small area of tertiary conglomerate up to about 3,000 feet elevation. The type of forest found here on northern aspects, with

moderate slopes, seems to bear a much closer resemblance to the Bhabar than the Hill type, as might be expected from the nature of the subsoil.

Bhabar sal.

Descending to the Bhabar we find *sal* occupying the highest river terraces of the Bhabar proper, also the more ancient Bhabar deposits of the Duns which lie between successive Siwalik ranges or between them and the outermost ranges of the Himalaya. The *sal* in these tracts may be regarded as the climax to a succession of forest communities commencing with the riverain and passing through the miscellaneous types already described. The soil is usually a moist loam overlying extensive beds of sand, river gravel and boulders. The permanent water table is at a great depth but the highly permeable subsoil usually ensures a considerable degree of moisture in the upper layers. As already mentioned the undergrowth in the Bhabar *sal* areas is often dense and is composed to a large extent of *Clerodendron infortunatum* which grows gregariously over extensive areas. The genera *Flemingia* and *Desmodium* are well represented. There are no less than four common species of *Desmodium* namely *D. polycarpum*, *D. laxiflorum*, *D. gangeticum* and *D. pulchellum* whilst three species of *Flemingia* are also common namely *F. bracteata*, *F. semialata* and *F. prostrata*. Climbers are normally abundant and special mention may be made of *Millettia auriculata* and (in the Haldwani Division) *Dalbergia volubilis*. When blanks are formed in the forest two grasses which commonly appear are *Imperata arundinacea* and *Anthistiria gigantea*.

Tarai sal.

Below the Bhabar the *sal* continues into the Tarai, where it is usually confined to ground which is only slightly raised above the level of swamps and waterlogged "chaors" (flat grassy areas). These forests constitute the true Tarai type of *sal*. The water level is never far below the surface of the ground and excessive moisture and inferior aeration have produced a far poorer type of *sal* to that which is found on the Bhabar deposits. On high river banks (damars) and in their vicinity the forest generally improves owing to better drainage. Throughout the Tarai the subsoil is usually sand with little or no indication of gravel or boulders, but in some cases the strata change to clay and then the soil becomes still less favourable to the *sal*. The grassy chaors which intersect the *sal* forests of the Tarai are often extensive. They are frequently only slightly below the level of the forest, a drop of two or three feet being sufficient in some cases to change the forest into grass

land. The dominant grasses in these chaors are *Anthistiria gigantea*, *Erianthus Ravennæ*, *Saccharum spontaneum*, *Saccharum Narenga* and *Andropogon muricatus*, and in such localities trees and shrubs are either widely scattered or entirely absent. Some trees typical of chaors are—*Bombax malabaricum*, *Lagerstræmia parviflora*, *Lannea grandis*, *Mitragyna parvifolia*, *Butea frondosa*, *Careya arborea* and *Randia uliginosa*, whilst *Helicteres Isora* is often abundant, half hidden beneath the grass. All the above species are necessarily fire resistant since the grass is frequently if not annually burnt.

D. EVERGREEN FORESTS IN SWAMPS AND MOIST LOCALITIES.

Forests of this type are of limited extent since the waterlogged conditions of the soil necessary for their existence are rarely present. They occur for the most part along the banks of Tarai streams and to a much more limited extent along the banks of streams in the outer ranges up to about 2,500 feet elevation. In the latter case evergreen forest is restricted to a narrow belt sometimes only a few feet wide on either side of the stream. In the Tarai the belt is often much wider and under exceptionally favourable conditions may extend 100 yards from either bank. It would be possible to subdivide the evergreen forests into a swamp type, a moist miscellaneous type and a type bordering the banks of ravines in the hills. These types are however essentially one and only differ in that there is a larger excess of water in the swamp type which is therefore slightly more deciduous in character than the other two. This is shown by the presence of such deciduous species as *Trewia nudiflora*, *Bischoffia javanica* and *Ficus glomerata* which are mainly characteristic of the swamp forests and only found to a limited extent in the other types. In evergreen forests the tree canopy is usually dense, and is composed of a number of species none of which is gregarious with the exception of *Eugenia jambolana* and to a less extent *Trewia nudiflora*. The tree canopy may be two storied or not, but is almost invariably standing over a dense growth of evergreen shrubs. Grasses are normally absent but there may be an abundance of ferns. The soil is usually black owing to the presence of much raw humus. The most typical tree species in addition to those already mentioned are—*Eugenia jambolana*, *Mallotus philippinensis*, *Xylosma longifolia*, *Phæbe lanceolata*, *Carallia integerrima*, *Alstonia scholaris* and to a somewhat less extent *Cedrela Toona*. *Calamus tenuis* often forms impenetrable cane brakes over considerable areas of the true swamp type. The commonest shrubs are—*Ardisia solanacea*, *Murraya Kœnigii*, *Glycosmis pentaphylla*, *Adhatoda Vasica* and *Dædalacanthus nervosus* whilst *Citrus*

medica, *Ligustrum robustum* and *Hyptianthera stricta* are also typical but not always present.

E. MISCELLANEOUS DECIDUOUS FORESTS AT LOW ELEVATIONS
IN THE HILLS.

These forests are found throughout the central and outer hill ranges up to about 4,000 feet elevation, above which they usually give place to the *chir* pine. They occur on all aspects and therefore differ much in composition. The slopes are frequently steep and always well drained and this combined with high temperatures produces conditions of great dryness. In this important respect the conditions are similar to those which exist in the miscellaneous forests of the Bhabar. There is however this important difference; the Bhabar soil is of great depth and porosity whilst in the hills the soil is usually shallow. The conditions in the Bhabar are therefore more favourable and the composition of these two types of forest is sufficiently diverse to justify their separation.

The trees are mostly deciduous, being leafless or nearly so during the hot weather. The only species of tree found gregariously over large areas is *Anogeissus latifolia*, such gregarious forest being mainly restricted to south aspects. A characteristic of all these forests is their poor height growth, fifty feet being seldom exceeded. On southern aspects an open canopy is the rule and where, as is so often the case, lopping and browsing have been excessive the forests rapidly deteriorate into a scrub composed of such shrubs as *Carissa opaca*, *Rhus parviflora* and *Woodfordia fruticosa*. The commonest trees in addition to *Anogeissus* are—*Ougeinia dalbergioides*, *Terminalia tomentosa*, *Bauhinia variegata*, *Bauhinia retusa*, *Lannea grandis*, *Mallotus philippinensis*, *Sapium insigne*, *Sterculia villosa*, *Engelhardtia Colebrookiana* and *Glochidion velutinum*.

Shrubs are largely subdeciduous such as *Indigofera pulchella*, *Rhus parviflora*, *Woodfordia fruticosa* and *Murraya Kænigii*, or evergreen such as *Adhatoda Vasicá*, *Colebrookia oppositifolia* and *Carissa opaca* all of which are common. *Nyctanthes arborescens* which is deciduous and often gregarious is typical of dry southern slopes and especially of secondary-growth scrub forest.

F. FORESTS OF *chir* (*Pinus longifolia*).

These ordinarily extend on south aspects from 3,500 to 7,000 feet and on north aspects from 3,000 to 6,500 feet elevation. *Chir* is found on all geological formations which occur within its range, though on certain southern slopes with a limestone subsoil it is unable to exist on account of the dryness of the soil combined with high temperatures. Nevertheless *chir* forests can establish themselves on dry southern aspects where owing to the xerophytic conditions and the prevalence of fires few

other tree or shrub species survive. In all *chir* forests the pine is the sole dominant, and it is not at all unusual to find it the only tree species present, though on north aspects where there is more moisture in the soil and fires are less destructive, scattered trees of other species may occur. They are however rarely present in sufficient numbers to produce anything approaching a second story. Moreover the *chir* itself seldom forms very dense forest. The ground is always covered with a more or less dense crop of grasses whatever the aspect or density of the overhead canopy, and there is also a discontinuous undergrowth of shrubs often so widely scattered that at a short distance their presence is scarcely noticeable.

The open nature of the forests, the absence of other tree species and the poverty of undergrowth are attributable partly to fires which have in the past swept annually throughout their length and breadth, partly to the zerophytic conditions under which they grow and partly to the fact that the *chir* zone is often closely associated with cultivation and its attendant heavy lopping and felling. The *chir* itself is especially adapted to withstand fires by means of its thick bark, its coppicing powers whilst young and its rapid growth when once established. In the same way practically every common shrub found in *chir* forest is adapted in some way to resist fire, for instance by means of deciduous shoots as with *Indigofera Dosua* and *Clerodendron serratum*, or by means of a vigorous power to produce rootsuckers as with *Ougeinia dalbergioides* and *Woodfordia fruticosa*, or unusual powers of reproduction by coppice shoots as with *Ficus Roxburghii*, *Glochidion velutinum* and many others. In the case of *Hamiltonia suaveolens* strong powers of coppicing are combined with a thick succulent bark to the roots, which enables this shrub to exist on the hottest and driest slopes. The majority of subsidiary species are deciduous or partly so, dropping their leaves as a rule from March to May and not, as with the deciduous species of higher levels, during the winter months.

Towards its lower limit *chir* passes insensibly into forest of mixed miscellaneous species and less frequently direct into *sal* forest. Among species of the miscellaneous forest which frequently occur with *chir* are—*Embllica officinalis*, *Ougeinia dalbergioides*, *Bauhinia variegata*, *Ficus Roxburghii*, *Glochidion velutinum* and *Hamiltonia suaveolens*. On rocky southern aspects *Euphorbia Royleana* is often abundant and in areas subject to heavy grazing and lopping *Rhus parviflora* and *Woodfordia fruticosa* sometimes form an undergrowth of varying density and extent. Towards its upper limit and in moist or shady ravines the *chir* gradually gives place to *banj*. *Aechmanthera tomentosa*, *Indigofera pulchella* and *Desmodium sambuense* are often abundant in these upper *chir* areas.

G.

FORESTS OF *banj* (*Quercus incana*).

The three principal oaks are the *banj*, *moru* and *karshu* and each occupies a more or less distinct altitudinal zone. Before proceeding to a special account of each oak type the following facts which apply equally to all, are of special interest. The soil is usually moist though due south aspects often form marked exceptions and there is a high degree of atmospheric humidity throughout the monsoon period from mid-June to mid-September irrespective of aspect. The effect of this is seen in the characteristic manner in which the trees are draped in a rich epiphytic flora of mosses, ferns and lichens. Fires have probably passed through the forests situated on south aspects at intervals of a few years and have considerably influenced its density and composition. On north aspects fires have been much less frequent and their influence has not been a factor of great importance. On the other hand the influence of man on these forests has been very great. All the oaks are good fodder and continuous unregulated lopping has converted or is still converting the more accessible forests into scrub. This scrub according to the special local conditions will either pass into grassland or will give place to a bushy secondary growth which usually consists very largely of the following shrubs—*Berberis asiatica*, *B. Lycium*, *B. aristata*, DC. *B. Chitria*, *Spiraea canescens*, *Prinsepia utilis*, *Elscholtzia polystachya* and *Cratægus crenulata*.

In all the oak and silver fir forests about to be described there is usually a more or less extensive ground flora of herbaceous plants which die down after the rains. To name a few conspicuous examples, *Pteridium aquilinum* is often characteristic of open *banj* forests, *Senecio rufinervis* forms dense undergrowth in many forests of *karshu* or silver fir, whilst *Polygonum amplexicaule* is sometimes abundant in *moru* forests.

Banj is ordinarily found between 6,000 and 8,000 feet elevation, but it also occupies the moister ravines running down into the *chir* zone where it often reaches as low an elevation as 3,500 feet. A notable feature of this species is its capacity to establish itself on the most unfavourable south aspects, but whilst such forests are always very open those on north aspects are usually dense. In the former case the ground is almost invariably clothed with dense grass, which on northern aspects may be almost absent. The *banj* oak itself has considerable fire-resisting qualities, the most important of which is probably its great power of reproduction by coppice shoots. There are few other trees which successfully compete with it, though there are always a few broad-leaved deciduous trees scattered through the forest. On south aspects there is

usually amongst the grass a number of scattered small shrubs with fire-resisting adaptations such as *Flemingia fruticulosa* and *Indigofera Dosua* the shoots of which die back more or less completely each year. On the other hand north aspects produce a fairly dense second story of small trees and shrubs which are about equally evergreen and deciduous, though the general effect produced is rather that of an evergreen undergrowth because the commonest species such as *Rhododendron arboreum* and some of the laurels are evergreen. There are few common tree species in *banj* forests with the exception of *Pieris ovalifolia* though some such as *Litsaea umbrosa* and *Ilex diphyrena* are locally common. With shrubs it is a different matter and the number of common shrubs is very large. The commonest are *Berberis asiatica*, *B. Chitria*, *Desmodium tiliaefolium*, *Indigofera Gerardiana* and *Lindera pulcherrima* whilst amongst undershrubs may be mentioned *Caryopteris grata*, *Inula Cappa*, *Myrsine africana*, *Plectranthus Caetsa*, *Strobilanthes alatus*, *S. Dalkousianus*, *S. glutinosus* and in moist places *Elscholtzia flava*. Mention must also be made of the ringal *Arundinaria falcata* which is often abundant.

H.

FORESTS OF *moru* (*Quercus dilatata*).

- *Moru* forests are found from 6,500 to 9,000 feet elevation and these forests occupy to a large extent an intermediate zone between the *banj* and *karshu*; but whereas the two latter form extensive forests on south aspects, the *moru* only occurs sporadically in such localities. It attains its maximum development at elevations between 7,000 and 8,000 feet on deep moist soils and especially where the subsoil is limestone. The canopy is generally dense and there is nearly always a thick second story, partly evergreen and partly deciduous, composed of small trees and shrubs of varying sizes. On account of the density of the growth and the prevailing moist conditions fires only penetrate in exceptional years. There are usually a few scattered trees of other species competing with the *moru* for dominance, the commonest of which are *Quercus incana*, *Q. semecarpifolia*, *Betula alnoides*, *Carpinus viminea* and *Acer cœsium*. Other common tree species are *Ilex diphyrena*, *Euonymus pendulus*, *Machilus Duthiei* and *Symplocos ramosissima* all of which are evergreen. Many of the shrubs commonly found in *banj* forest are almost equally common in *moru* forest, but the following additional species may be mentioned, namely—*Staphylea Emodi*, *Sarcococca saligna*, *Barringtonia albiflora* and *Strobilanthes Wallichii*. The ringal *Arundinaria Falconeri* is also not infrequently present.

J. FORESTS OF *karshu* (*Quercus semecarpifolia*).

The *karshu* occupies the highest zone amongst the oaks, and forests of this species are found between 7,500 and 11,500 feet over very extensive tracts. It is found equally on north and south aspects, and in the extensive areas occupied by this type of forest the *karshu* has few successful competitors besides *Abies Pindrow* and *Quercus dilatata*. The fir however only occurs on a small fraction of the area occupied by *karshu*, and *moru* can only compete with success on north aspects towards the lower limit of the *karshu*. At its lower limit it most frequently passes into *banj* forest though on due north aspects it often gives place to *moru*, spruce or silver fir. At its upper limit it passes into forests of birch, silver fir and rhododendron, though on south aspects it more usually passes directly into pasture land, the passage being always abrupt without any gradual transition.

Typical forests of *karshu* on both north and south aspects are dense. A second story of tree species is sometimes present but is often only represented by scattered individuals and may be entirely absent. A third story of shrubs is always present under normal conditions and varies in density inversely with that of the overhead cover. *Rhododendron arboreum* is still almost as abundant in the *karshu* forests as it was 3,000 feet lower in the *banj*. Among the commoner tree species in the second story may be mentioned *Ilex diphyrena*, *Acer casium*, *Acer pictum*, *Acer acuminatum* and locally *Taxus baccata* the yew. Shrubs occur in great variety but some of the commonest are—*Rosa sericea*, *Rosa macrophylla*, *Cotoneaster acuminata*, *Salix elegans*, *Ribes glaciale*, *Strobilanthes atropurpureus*, *Viburnum foetens*, *V. stellulatum* and *V. cotinifolium*. The last named is equally abundant in all types of oak forest from *banj* to *karshu*. Two species of ringal are characteristic, namely—*A. jaunsarensis* and *A. spathiflora*, both of which form dense and continuous undergrowth beneath the oak over extensive areas. The combination of *karshu* with *A. jaunsarensis* is estimated to occupy more than 50 square miles in Garhwal alone.

K. FORESTS OF SILVER FIR (*Abies Pindrow*).

The low-level silver fir is found between 7,000 and 10,500 feet elevation and forms continuous forest between 8,000 and 9,500 feet. The only occurrence of this species on the outer hill ranges is a small community at Debthal about 15 miles east of Naini Tal. There is also an outlier in the Thali reserve in East Almora. With these two exceptions it is restricted to the higher central ranges and the main Himalayan range itself. Wherever the silver fir occurs it is the dominant species though

when mixed with spruce, as is not infrequently the case, the two are conjointly dominant. It is very exceptional to find a forest in which the silver firs are sufficiently dense for their crowns to be actually in contact, and in the majority of silver fir forests they are more or less widely scattered. This however does not imply that the ground is incompletely covered. On the contrary even in the forests where the trees are widely scattered the soil is seldom exposed because a second story of trees is always present, except in the very densest forests, and a third story of shrubs is also never entirely absent and may be comparatively dense also. In forests lying south of the main Himalayan range the second story is most frequently composed of either *karshu* or *moru* oak, but north of this as the oaks disappear their place is taken by a mixture of broad-leaved deciduous species the commonest of which are *Ulmus Wallichiana*, *Aesculus indica*, *Acer cæsum* and *Corylus Jacquemontii*. Common shrubs composing the third story are *Rosa macrophylla*, *Deutzia staminea*, *Viburnum stellulatum*, *V. nervosum*, *Berberis affinis* and *Strobilanthes Wallichii*, whilst the two ringals *Arundinaria jaunsarensis* and *A. spathiflora* are often found in abundance.

L. FORESTS OF BLUE PINE (*Pinus excelsa*).

Fairly extensive forests of blue pine exist beyond the main range within the drainage of the Alakhnanda river, whilst south of the main range only small patches of forest occur and then almost invariably on limestone. This species is not found in the valleys immediately east of the Pindar, but reappears in the Dhauli and Kali valleys of the Almora district. Its range of altitude is very variable and is probably largely dependent on the snowfall. The outlying patches south of the main range are found between 6,000 and 8,500 feet, immediately north of the main range between 6,500 and 10,000 feet, whilst in the still drier tract around Malari and Niti it is found between 10,000 and 12,000 feet, scattered trees being occasionally found up to 12,500 feet. Immediately north of the main range the principal tree associates vary according to elevation. Thus between 6,500 and 7,500 feet cypress and deodar are often present, from 7,500 to 9,000 feet spruce, from 8,500 to 9,500 feet *Abies Pindrow*, and from 9,500 to 10,000 feet *Abies Webbiana*. Forests of blue pine usually pass into *Betula utilis* or *Abies Webbiana* at their upper limit and into deodar or cypress at their lower. Dense crops are quite exceptional owing to the disastrous fires which sweep periodically through the areas. These fires may at times practically exterminate the whole forest and it is solely due to its wonderful reproductive powers that the species has been enabled to maintain itself. Under most forests there is a more or less dense crop

of grass and in all such cases shrubs are conspicuously absent. Those that occur are usually well adapted to resist damage by fire, for example *Indigofera Gerardiana*, *Hypericum cernuum*, *Rhus Cotinus*, *Indigofera Dosua* and *Excacaria acerifolia*. Other common shrubs are *Aralia cissifolia*, *Artemisia vestita* and *Salix elegans*.

M. FORESTS OF SPRUCE (*Picea Morinda*).

Spruce is not found east of the Garhwal district and, as in the case of the blue pine, such forests as occur south of the main range are usually found on limestone or in localities where the rainfall is believed to be below the average for the surrounding country. Here they are usually restricted to elevations between 7,000 and 9,000 feet though to the north of the main range they reach 10,000 feet. The spruce is restricted entirely to north or northerly aspects. Forests in which it is the sole dominant are exceptional and south of the main range it is usually found associated with *Quercus semecarpifolia* or *Q. dilatata* whilst north of the main range the principal associates are *Abies Pindrow* and *Pinus excelsa*. Forests of spruce mixed with broad-leaved deciduous species also occupy extensive areas and are a marked feature of the landscape, since the tall conifers stand out like sentinels towering high above the broad-leaved forest which surrounds them. Spruce forests are often dense and usually contain a distinct second story composed of broad-leaved trees such as *Aesculus indica*, *Corylus Jacquemontii*, *Juglans regia*, *Acer cæsum* and *Rhus punjabensis*. There is also as a rule a distinct and often dense third story of shrubs such as *Rhamnus virgata*, *Berberis Chitria*, *Desmodium tilicefolium*, *Viburnum stellulatum* and *Sarcococca saligna*.

N. FORESTS OF CYPRESS (*Cupressus torulosa*).

Cypress forest occurs south of the main Himalayan range as well as to the north, but in the former case only in small and scattered patches and then invariably on a limestone soil on account of its comparative dryness. That lime is not in any way necessary to the cypress is shown by the fact that in the drier climate to the north of the main range it grows freely on quartzite as well as gneiss. Forests of this species are found between 6,500 and 9,500 feet. It is capable of existing on rocky precipitous slopes with little soil beyond what lodges in the crevices of the rocks though in such situations the growth is always stunted and the trees are scattered. Cypress is extremely susceptible to fire at all stages of its life and it is probably this susceptibility more than any other cause which has driven it to cling to the steep rocky precipices and to shun all grassy areas. Exceptions occur in the case of a few isolated patches south of the main range in which a deep soil

favours a dense growth of associated species which, by reacting on the naturally moist conditions, create a barrier to the advance of fire. North of the main range it invariably forms open forest composed of scattered individuals, usually on steep rocky ground. In these localities the trees have to contend with heavy sheep grazing in addition to periodic fires of a destructive nature. Such forests as exist south of the main range are often associated with *Quercus dilatata* with or without an undergrowth of *Arundinaria Falconeri*, *A. jaunsarensis* and other shrubs. North of the main range the principal tree associates are blue pine and deodar, whilst common shrubs include *Abelia triflora*, *Berchemia lineata*, *Coriaria nepalensis* and *Spiraea vacciniifolium*.

O. FORESTS OF DEODAR (*Cedrus Deodara*).

South of the main Himalayan range deodar only occurs sporadically in a few blue pine and cypress forests. North of the main range it is found within the drainage of the Alakhnanda river where it forms more or less pure forests between 8,000 and 10,000 feet. The forests are open and the trees do not attain a great height, but heavy sheep grazing and the steep rocky nature of the slopes where it is mainly found are factors which have undoubtedly had a material effect on its condition. Few tree species are found associated with deodar in these forests and the undergrowth is usually scanty consisting largely of *Abelia triflora*, *Lonicera hypoleuca*, *Juniperus macropoda*, *J. communis*, *Prunus Jacquemontii*, *Ribes Grossularia* and *Rosa sericea*.

P. FORESTS OF MIXED HARDWOODS.

These are to be found to a considerable extent south of the main range as well as to the north. They are invariably found either on north aspects or as strips along the bottoms of sheltered valleys. Forests of this type seldom occur over large continuous areas, and they seem to demand a fairly deep and moist soil. The tree species are all deciduous and usually occur mixed though some, such as *Aesculus indica*, *Acer caesium* and *Corylus Jacquemontii* may constitute up to 75 per cent. of the dominant crop and thus form nearly pure forests. Other common species found in these forests are *Ulmus Wallichiana*, *Celtis australis*, *Juglans regia*, *Rhus punjabensis* and *Acer pictum*. The leaf canopy is frequently dense but there is also as a rule an undergrowth consisting of various shrubs.

Q. FOREST OF BIRTH (*Betula utilis*).

The high-level birch forests are chiefly characteristic of the tracts lying to the north of the main Himalayan range though narrow strips

of such forest are also common on north and west aspects to the south of the main range. It is usually found between 9,500 and 11,500 feet elevation, though in the area of lighter snowfall towards Niti it is commonly found up to 12,000 feet. The overhead canopy is generally open, but there is almost invariably a dense undergrowth of shrubs about 90 per cent. of which is often composed of *Rhododendron campanulatum* and *Pyrus foliolosa* or *Pyrus microphylla*. Other shrubs which often form dense undergrowth in these forests are *Lonicera alpigena*, *L. purpurascens* and *Rubus niveus*.

R.

FORESTS OF SILVER FIR (*Abies Webbiana*).

The high-level silver fir never forms continuous forest of large extent; on the contrary it tends to occur in small patches here and there in company with *Quercus semecarpifolia* or *Betula utilis*, but chiefly the latter. It is practically never found on a south aspect and even on north aspects pure forest of this species is a rare occurrence. There are a few small forests south of the main range at elevations between 9,500 and 11,000 feet, where it is found along the uppermost limit of the oak forest, and if birch forest is absent it may pass directly into pasture land. North of the main range, forest is found up to 12,500 feet. In mixtures of birch and silver fir the latter is dominant and forms as a rule an upper open story with crowns widely separated. The lower story of birch is often fairly dense and below this again there may be a dense undergrowth of shrubs of which the following are among the commonest—*Cotoneaster acuminata*, *Rosa sericea*, *Ribes glaciale*, *Ribes rubrum* and more locally *Rhododendron barbatum*.

S.

ALPINE BUSHLAND.

Above the birch and silver fir forests there is often a gradual transition through zerophytic bushland into alpine pasture. The species composing this bushland are also found in open places at lower elevations where less favourable conditions prevent the formation of tree forest. Thus the lower altitudinal limits of such shrubby growth correspond roughly with those of the birch forest though the upper limit extends above the birch to 13,500 feet. The bushy growth we are now considering is discontinuous in the sense that it occurs in more or less isolated patches varying in extent from a few square yards up to perhaps 100 acres. It attains its greatest development on north aspects. The terrain is often steep and strewn with boulders and is frequently intersected by rocky precipices. The largest of the species are *Rhododendron campanulatum* and *Pyrus foliolosa* which also form the largest individual patches of growth. The remaining species are all dwarf and do not exceed 3 feet in

height. The principal of these are—*Lonicera obovata*, *L. parvifolia*, *Rhododendron Anthopogon*, *R. lepidotum* and *Salix fruticulosa*, whilst creeping amongst the loose boulders or on steep grassy banks will be found *Polygonum vacciniifolium* and *Salix Lindleyana*. *Berberis umbellata* and *B. Kumaonensis* may also be included here, but they are usually met with on steep grassy slopes with a southern aspect.

T.

RIVERSIDE BUSHLAND.

The type of bushland found growing along the well watered banks of streams and rivers at high elevations is composed of very few species and from the restricted extent of such localities embraces a comparatively small area. *Salix hastata* and *S. sclerophylla* are two of the principal shrubs, the former attaining a height of 8 feet the latter only 4 feet. Another less common species which usually grows on banks of open shingle is *Myricaria germanica*.

V.

HILLSIDE BUSHLAND.

The shrubs composing this type of bushland are all under 5 feet high and mostly under 2 feet. They occur either as scattered individual plants which cover perhaps one half or less of the surface of the ground, or else in small frequently dense patches scattered over the otherwise bare rocky and shaly slopes. All have some adaptation to protect them from the browsing of sheep which wander over these tracts in large herds. For instance the leaves of *Artemisia maritima* and *A. sacrorum* are strongly aromatic, *Caragana Gerardiana* and *C. pygmaea* possess numerous strong and sharp spines; *Hippophae rhamnoides*, *Lonicera rupicola* and *L. spinosa* develop stiff spinescent branches; whilst *Juniperus communis* and *J. pseudosabina* have resinous distasteful foliage. The broad-leaved species are deciduous and possess various well marked adaptations to retard transpiration. In addition to the species already mentioned *Eurotia ceratoides* and *Lonicera glauca* are common.

In concluding this short account of the climate, geology and forest vegetation I have pleasure in acknowledging much useful information obtained from local working plans and from the following publications :—

“ Silviculture of Indian trees,” Vols. I—III. TROUP.

“ Some Indian forest grasses and their ecology,” *Ind. Forest Mem.*, Vol. I, Part I. HOLE.

“ Forests of the Kumaun Bhabar ” *Forest Bull.* No. 45. SMYTHIES.

" The influence of the hand of man on the distribution of forest types in the Kumaun Himalaya," *Ind. Forester*, 1923. CHAMPION.

" The ecology of Tehri Garhwal," *Journ. of Ind. Bot. Soc.*, Vol. IV, 1925. DUDGEON and KENOYER.

Those interested in the subject will also find some further information in an article by me entitled " Notes on the forest communities of the Garhwal Himalaya " published in Vol. X, No. 2, 1922, of the *Journal of Ecology*.

Synopsis of the Families.

The distinguishing characters of the families have been selected with special reference to the plants described. In the body of the work under each family an account of the family as a whole will be found. The plants here mentioned all belong to the **Phanerogams** or flowering plants. They are divided as follows:—

A.—Angiosperms. Ovules contained in a closed ovary, fertilized through the stigma and style. *Families I—XCI.*

I.—Dicotyledons. Leaves net-veined. Parts of the perianth usually in fours or fives. Embryo with two cotyledons. *Families I—LXXXVII.*

(a) **Polypetalæ.** Flowers usually bisexual, usually with calyx and corolla, the latter consisting of distinct petals. *Families I—XLVII.*

(i) **Thalamifloræ.** Sepals usually distinct, petals and stamens hypogynous, disk usually absent, ovary free. *Families I—XVII.*

(ii) **Discifloræ.** Sepals distinct or connate, petals sometimes connate at the very base, torus usually expanded into a disk between the petals and the ovary, ovary often immersed in the disk. *Families XVIII—XXXV.*

(iii) **Calycifloræ.** Calyx usually of combined sepals, petals distinct or united at the base, disk thin or wanting, stamens perigynous or epigynous. *Families XXXVI—XLVII.*

(b) **Gamopetalæ.** Flowers usually bisexual, usually with calyx and corolla, the latter consisting of connate petals. *Families XLVIII—LXVII.*

(c) **Monochlamydeæ.** Flowers often unisexual, perianth-lobes or—segments 1-seriate or if 2-seriate both usually calycine. *Families LXVIII—LXXXVII.*

II.—Monocotyledons. Leaves on sheathed or broad-based petioles, the blade usually with parallel veins joined by undivided transverse veins. Parts of the perianth usually in threes or multiples of three. Embryo with one cotyledon. *Families LXXXVIII—XCI.*

B.—Gymnosperms. Flowers unisexual, perianth none or incomplete. Ovules not enclosed in an ovary, fertilized by direct contact with the pollen-grain or through a tube formed by the integument. *Families XCII—XCIV.*

I.—Dicotyledons.

(a) Polypetalæ

(i) Thalamifloræ.

I.—Ranunculaceæ. Climbing shrubs. Leaves opposite, compound. Sepals usually 4, herbaceous, deciduous and petaloid. Petals wanting. Stamens numerous. Carpels numerous, 1-ovuled. Fruit a head of achenes.

II.—Magnoliaceæ.—Trees or climbers. Leaves alternate, simple. Sepals and petals alike in whorls of three, imbricate, deciduous. Stamens numerous. Carpels numerous, free or slightly cohering. Fruit a spike.

III.—Anonaceæ. Trees or shrubs. Leaves alternate, entire, exstipulate. Sepals 3. Petals 6, in two series. Stamens numerous, free. Carpels numerous, free. Fruit a ring of succulent carpels.

IV.—**Menispermaceæ.** Climbing shrubs or small trees. Leaves alternate, entire or lobed, usually palminnerved, often peltate. Flowers small, unisexual, trimerous. Stamens as many as and opposite the petals, or anthers sessile on a column. Ovaries 1 or 3, free. Fruit a drupe. Seed horse-shoe shaped.

V.—**Berberidaceæ.** Shrubs, erect or climbing, often armed. Leaves alternate, simple or compound. Sepals 6, petaloid, in two whorls. Petals 6. Stamens 6, opposite the petals, opening by slits or ascending valves. Carpels 1 or 3, free. Fruit a berry.

VI.—**Capparidaceæ.** Trees or shrubs, often scandent, sometimes armed. Leaves alternate, simple or digitate. Sepals 4. Petals 4. Stamens numerous; filaments long, filiform. Ovary syncarpous with 2-4 parietal placentae, seated on a gynophore, style 0. Fruit an ovoid or globose berry, fleshy or with woody rind.

VII.—**Bixaceæ.** Trees or shrubs, often armed. Leaves alternate, simple, stipules 0 or minute. Flowers showy and bisexual or small and dioecious. Sepals 4-5. Petals 5 or 0. Stamens numerous, free. Ovary usually 1-celled, placentae 2-many, parietal. Fruit a berry or capsule.

VIII.—**Pittosporaceæ.** Evergreen trees or shrubs. Leaves alternate, exstipulate. Flowers bisexual, 5-merous. Sepals and petals free or connate. Stamens 5, free. Ovary 1-celled, or 2-5-celled by the intrusion of as many parietal placentae. Fruit a woody capsule.

IX.—**Tamariscaceæ.** Shrubs or small trees. Leaves alternate, small or scale-like. Flowers small, white or pink. Sepals and petals 5 each, free. Stamens 5 or 10, free or connate. Ovary 1-celled or imperfectly 2-5-celled; placentae 2-5, basal. Fruit capsular. Seed plumose.

X.—**Hypericaceæ.** Shrubs. Leaves opposite, gland-dotted, exstipulate. Flowers yellow, bisexual. Sepals and petals 5 each, free. Stamens numerous, filaments long, filiform, 5-adelphous at the base. Ovary 5-celled. Fruit a capsule. Seeds very numerous, minute.

XI.—**Ternstroemiaceæ.** Trees, shrubs or climbers. Leaves alternate, simple, exstipulate. Flowers usually bisexual. Sepals 5. Petals 5, more or less connate at the base. Stamens 5-15 or numerous, adnate to the base of the petals. Ovary 2-many celled. Fruit baccate or capsular.

XII.—**Dipterocarpaceæ.** Trees. Leaves alternate, entire, coriaceous, stipulate. Flowers yellowish in racemose panicles. Sepals 5, connate. Petals 5. Stamens up to 50, connective with a subulate appendage. Ovary 3-celled. Fruit with 3 long wings formed from the calyx-segments.

XIII.—**Malvaceæ.** Herbs, shrubs or trees. Leaves alternate, usually simple and palminnerved, stipulate. Flowers often with an involucre below the calyx. Sepals 5, valvate, more or less connate. Petals 5, united at the base to the staminal column. Stamens numerous, monadelphous or rarely 5-adelphous; anthers 1-celled. Ovary syncarpous of 2-many carpels. Fruit dry, of dehiscent cocci or capsular.

XIV.—**Sterculiaceæ.** Shrubs or trees. Leaves alternate, simple, often palmately lobed, stipulate. Sepals 5, valvate, connate. Petals 5 or 0. Stamens in two series, those opposite the sepals reduced to staminodes or wanting, those opposite the petals monadelphous, usually indefinitely branched; anthers 2-celled. Ovary of 5 sub-distinct carpels. Fruit dry of distinct straight or spirally twisted follicles.

XV.—**Tiliaceæ.** Herbs, shrubs or trees. Leaves alternate, simple, usually palminnerved, stipulate. Sepals 4-5, free. Petals 4-5, free, often glandular at the base. Stamens 5-numerous, free; anthers 2-celled. Ovary 2-5-celled. Fruit drupaceous or capsular or dry and indehiscent or splitting into cocci.

(ii) **Discifloræ.**

XVI.—**Linaceæ.** Shrubs. Leaves alternate, glabrous, stipules minute. Flowers yellow, regular, bisexual. Sepals and petals 5 each, free. Stamens 5, connate at the base with small interposed staminodes. Disk inconspicuous of 2-3 glands adnate to the staminal tube. Ovary 3-5-celled, cells spuriously 2-locellate. Fruit a capsule.

XVII.—**Malpighiaceæ.** Climbers. Leaves opposite, simple, entire, exstipulate. Calyx 5-partite, one of the segments glandular outside or (*Aspidopterys*) aglandular.

Petals 5, clawed and fimbriate or (*Aspidopterys*) not clawed and entire. Stamens 10, very shortly connate at the base. Disk obscure. Ovary 3-celled; styles 3 or 1. Fruit of 1-8 winged samaras.

XVIII.—**Rutaceæ**. Trees or shrubs, sometimes climbing. Leaves alternate, gland-dotted, aromatic, simple or compound, exstipulate. Flowers regular. Sepals and petals 4-5, the latter free. Stamens 4, 5, 8, 10 or numerous. Disk usually conspicuous. Ovary usually of 4-5 connate carpels. Fruit a capsule drupe or berry.

XIX.—**Simarubaceæ**. Trees or shrubs with bitter bark. Leaves alternate, imparipinnate. Flowers small, usually unisexual. Calyx 4-5-lobed. Petals 4-5, free. Stamens in males as many as the petals, free, inserted at the base of the disk. Carpels 2—5, free or connate. Fruit of 3-5 rather membranous drupes.

XX.—**Ochnaceæ**. Shrubs. Leaves alternate, simple, stipulate. Flowers regular, conspicuous, yellow. Sepals 5, free, persistent. Petals 5-10, free. Stamens numerous. Ovary 3-10-lobed, ovule 1 in each cell. Fruit of distinct drupes.

XXI.—**Eurseraceæ**.—Trees balsamiferous. Leaves alternate, paripinnate, exstipulate. Flowers small polygamous. Calyx 5-lobed. Petals 5, free. Stamens 10, free, inserted outside the disk. Ovary 4-5-celled. Fruit drupaceous.

XXII.—**Meliaceæ**. Trees. Leaves alternate, pinnate or bi- or tripinnate, exstipulate. Flowers regular, usually small. Calyx 4-5-lobed or subentire (*Dysoxylum*). Petals 4-5, free. Stamens 8-12, united into a tube or (*Cedrela*) free. Disk tubular or annular. Ovary 2-6-celled. Fruit a drupe or capsule.

XXIII.—**Oleaceæ**. Shrubs, erect or climbing. Leaves alternate, exstipulate. Flowers small, hermaphrodite. Calyx minute, cupular. Petals 3-6, valvate more or less connate. Disk small. Stamens 9-12 adnate to the petals, 3-5-fertile. Ovary 1-celled or at the base imperfectly 3-celled. Fruit a drupe.

XXIV.—**Illicaceæ**. Trees. Leaves alternate, usually coriaceous; stipules minute. Flowers small, usually dioecious. Calyx 4-5-fid, persistent. Petals 4-5, connate below in male flowers. Stamens 4-5, uniting the bases of the petals. Disk 0. Ovary 2-7-celled. Fruit a drupe.

XXV.—**Celastraceæ**. Trees or shrubs, sometimes armed, rarely climbing. Leaves opposite or alternate, simple, stipules small or 0. Flowers small. Calyx 4-5-lobed or partite. Petals 4-5, free. Stamens 4-5 inserted on the disk or beneath the margin of it. Disk conspicuous, surrounding the base of the ovary. Ovary 2-5-celled. Fruit a capsule or drupe.

XXVI.—**Rhamnaceæ**. Trees or shrubs, erect or climbing, sometimes armed. Leaves alternate or opposite, simple, usually stipulate. Flowers small, greenish. Calyx 4-6-fid. Petals 4-6 or 0, usually hooded over the stamens. Stamens opposite the petals. Disk filling or lining the calyx-tube. Ovary 2-4-celled, sometimes partially or wholly inferior. Fruit drupaceous or capsular, the capsule sometimes winged.

XXVII.—**Vitaceæ**. Climbing or erect shrubs, under-shrubs or herbs, the former tendril-bearing. Leaves alternate, simple or compound, stipulate. Flowers small, usually greenish. Calyx entire or 4-5-lobed. Petals 4-5, free or connate at the base or connate at the apex and falling off as a cap. Stamens 4-5, opposite the petals, free or (*Leea*) connate into a tube which is adnate to the petals. Disk intrastaminal, usually conspicuous. Ovary 2-6-celled. Fruit a berry.

XXVIII.—**Sapindaceæ**. Trees or shrubs. Leaves opposite or alternate, compound, or (*Acer*) simple. Calyx of 4-5 lobes or sepals. Petals 4-5 free or 0. Disk various, usually conspicuous. Stamens 4-10, free. Ovary 1-4-celled, entire or more or less deeply divided. Fruit various.

XXIX.—**Sabiaceæ**. Trees or shrubs erect or climbing. Leaves alternate, simple or (*Meliosma Wallichii*) pinnate, exstipulate. Calyx 4-5-partite. Petals 3-5, opposite the sepals. Stamens 4-5, opposite the petals, all or 2 only fertile. Disk intrastaminal. Ovary of 2-3 carpels or cells. Fruit a drupe.

XXX.—**Anacardiaceæ**. Trees or shrubs. Leaves alternate, simple, 3-foliate or pinnate, exstipulate. Flowers small. Calyx 3-5-partite. Petals 3-5 or (*Pistacia*) 0. Stamens 3-10, usually inserted outside, rarely on the disk. Ovary 1-celled or (*Spondias*) 4-5-celled. Fruit drupaceous, dry or succulent.

XXXI.—Coriariaceæ. Shrubs, glabrous. Leaves opposite, exstipulate. Flowers small, in axillary racemes. Sepals 5, persistent. Petals 5, persistent. Stamens 10, free, red. Disk 0. Carpels 5, free. Ripe carpels enclosed in the succulent purple petals.

XXXII.—Moringaceæ. Trees, large, deciduous. Leaves alternate 2-3-pinnate exstipulate. Flowers large, irregular. Calyx cup-shaped, 5-cleft, segments unequal, petaloid. Petals 5, unequal. Disk lining the calyx-tube. Stamens 5, fertile, opposite the petals, alternating with staminodes. Ovary 1-celled with 3 parietal placentae. Fruit a 3-valved capsule.

(iii) **Calycifloræ.**

XXXIII.—Leguminosæ. Herbs, shrubs or trees, sometimes climbing, often armed. Leaves alternate, 1-foliate or compound, stipulate. Flowers usually zygomorphic and bisexual. Sepals 5, free or connate. Petals 5 or rarely fewer by abortion. Stamens 10, rarely fewer, or numerous, free or connate. Carpel 1, free. Fruit a pod.

XXXIV.—Rosaceæ. Herbs, shrubs or trees, sometimes scrambling, often armed. Leaves alternate, simple or compound, usually stipulate. Flowers regular, pentamerous or (*Rosa sericea*) tetramerous, or in cultivation petals indefinite. Stamens usually indefinite. Carpels 1-many, usually distinct, often adnate to and enclosed in the calyx-tube. Fruit various.

XXXV.—Saxifragaceæ. Shrubs or trees, erect or (*Hydrangea altissima*) climbing, unarmed or (*Ribes Grossularia*) prickly. Leaves alternate or opposite, simple. Flowers regular, 4-5-merous. Stamens as many or twice or thrice as many as petals, or (*Philadelphus*) numerous. Ovary of 2-5 carpels, 1-5-celled, inferior or (*Itea*) half superior. Fruit a capsule or (*Ribes*) berry.

XXXVI.—Rhizophoraceæ. Trees or shrubs. Leaves opposite, entire or serrulate, glabrous. Flowers regular, small, 5-8-merous. Petals clawed, toothed or lacerate. Stamens twice as many as petals. Ovary semi-inferior, usually 3-5-celled. Fruit indehiscent, 1-celled, 1-seeded.

XXXVII.—Combretaceæ. Trees or shrubs, often climbing. Leaves alternate, subopposite or opposite, simple, entire, exstipulate. Flowers 4-5-merous, regular. Petals often wanting. Stamens 8 or 10, biseriate, the lower opposite the calyx-lobes, the upper opposite the petals. Ovary 1-celled, inferior. Fruit dry, indehiscent, usually angled or winged.

XXXVIII.—Myrtaceæ. Trees or shrubs. Leaves opposite, entire, usually evergreen and gland-dotted (epunctate in *Psidium*), exstipulate. Flowers regular, 4-5-merous. Petals sometimes united into a cap. Stamens numerous, filaments filiform, free or connate into a tube or into bundles. Ovary fused to the calyx-tube, 1-many-celled. Fruit a berry, drupe or capsule.

XXXIX.—Lecythidaceæ. Trees. Leaves alternate, serrate, crowded at the ends of the branches, exstipulate. Flowers large, showy, regular, 4-merous. Stamens numerous, in several rows; filaments filiform, slightly connate. Ovary fused to the calyx-tube, 4-5-celled. Fruit a berry.

XL.—Melastomaceæ. Shrubs. Leaves opposite, simple, exstipulate. Flowers regular, showy, 4-5-merous. Calyx-tube partially adnate to the ovary. Petals free. Stamens twice as many as the petals; anthers longer than the filaments, curved, opening by apical pores. Ovary usually 4-celled. Fruit a capsule.

XLI.—Lythraceæ. Trees or shrubs, often armed. Leaves opposite or subopposite or whorled, exstipulate. Flowers regular or (*Woodfordia*) oblique. Calyx-lobes 3-6. Petals usually as many as calyx-lobes, often crumpled. Stamens 12 or many. Ovary superior or (*Punica*) inferior. Ovary 2-6- or (*Punica*) many-celled. Fruit a capsule or (*Punica*) berry-like.

XLII.—Samydaceæ. Trees or shrubs. Leaves alternate, pellucid-punctate, stipulate. Flowers small, regular. Calyx persistent, deeply 4-5-lobed. Petals 0. Stamens 6-10, alternating with staminodes, free or connate. Ovary free, 1-celled; placentae 3-4, parietal. Fruit a succulent, 2-3-valved capsule.

XLIII.—Cucurbitaceæ. Climbers with spirally twisted tendrils. Leaves alternate, entire or palmately lobed. Flowers regular, white, 5-merous. Calyx-tube long. Petals connate at the base, fimbriate. Stamens 3, anthers usually connate. Ovary inferior, with 3 parietal placentae. Fruit a berry with a hard rind.

XLIV.—Datiscaceæ. Trees shrubs or herbs. Leaves alternate, simple or pinnate, exstipulate. Flowers small, regular, dioecious. Calyx 3-9-lobed. Petals 0. Stamens 9-25. Ovary 1-celled, fused to the calyx-tube. Fruit a capsule.

XLV.—Cactaceæ. Stem and branches jointed, succulent, prickly. Leaves minute or 0. Flowers showy. Sepals and petals alike, numerous, free or united into a tube. Stamens very numerous, anthers minute. Ovary 1-celled, adnate to the calyx-tube or inferior. Fruit a berry.

XLVI.—Araliaceæ. Trees or shrubs sometimes climbing. Leaves alternate, simple or compound, stipulate or (*Hedera*) exstipulate. Flowers small, regular, in umbels. Calyx-tube adnate to the ovary. Petals 5, free. Stamens 5, free, inserted round an epigynous disk. Ovary inferior, 2-5-celled. Fruit a small berry.

XLVII.—Cornaceæ. Trees or shrubs. Leaves opposite or alternate, exstipulate. Flowers regular. Calyx-tube adnate to the ovary. Petals 4-10, free, valvate. Stamens 4-10 or numerous, free, inserted round an epigynous disk. Ovary inferior, 1-4-celled. Fruit drupaceous.

(b) Gamopetalæ.

XLVIII.—Caprifoliaceæ. Shrubs or small trees. Leaves opposite, stipules minute or wanting. Flowers regular or zygomorphic. Calyx-tube adnate to the ovary. Corolla gamopetalous, 5-lobed. Stamens 4-5, inserted on the corolla. Ovary inferior, 1-5-celled. Fruit a drupe or berry rarely dry.

XLIX.—Rubiaceæ. Trees or shrubs sometimes armed. Leaves opposite or whorled, entire, stipules inter- or intrapetalolar, conspicuous. Flowers regular, usually 4-5-merous. Calyx-tube adnate to the ovary. Corolla gamopetalous. Stamens as many as corolla-lobes, inserted on the corolla. Ovary inferior 2- or 5- rarely 1-celled. Fruit usually a berry, drupe or capsule.

L. Compositæ. Herbs, shrubs or small trees. Leaves alternate, exstipulate. Flowers in heads surrounded by an involucre of bracts. Calyx-tube adnate to the ovary, limb 0 or of hairs or scales. Corolla gamopetalous, tubular or ligulate. Stamens 4-5, inserted on the corolla, anthers connate in a tube. Ovary inferior, 1-celled. Fruit an achene, with a tuft of hairs (except *Artemisia*).

LI.—Ericaceæ. Trees, shrubs or undershrubs. Leaves alternate or crowded usually coriaceous; exstipulate. Flowers 5-merous. Corolla campanulate or ovoid. Stamens 5-10, often inserted on the corolla. Ovary 4-9- usually 5-celled, superior. Fruit a capsule (in *Gaultheria* enclosed in the fleshy calyx and appearing baccate).

LII.—Plumbaginaceæ. Shrubs or undershrubs. Leaves alternate, entire, exstipulate. Flowers regular. Calyx gamosepalous, more or less tubular, persistent. Corolla salver-shaped, 5-lobed or of 5 petals. Stamens as many as, opposite and adnate to the bases of the corolla-lobes or petals. Ovary 1-celled, 1-ovuled. Fruit dry, included in the calyx.

LIII.—Myrsinaceæ. Trees or shrubs. Leaves alternate, simple, sometimes with resinous glands, exstipulate. Flowers small, regular, 4-5-merous. Calyx persistent. Corolla-tube short or petals free. Stamens as many as, opposite and adnate to or inserted on the corolla-lobes or petals. Ovary 1-celled, superior or (*Maesa*) half-inferior. Fruit small, dry or succulent.

LIV.—Sapotaceæ. Trees with milky juice. Leaves alternate, entire, simple, usually coriaceous. Flowers regular. Sepals 4-5, nearly distinct, persistent. Corolla tube short, lobes 6-14. Stamens 12-40 inserted on the corolla. Ovary 4-12-celled, superior. Fruit a berry.

LV.—Ebenaceæ. Trees, sometimes spinous. Leaves alternate or sub-opposite, simple, entire, exstipulate. Flowers dioecious, 4-5-merous. Calyx gamosepalous. Corolla gamopetalous. Stamens 4-many, filaments variously connate, often in pairs. Staminodes in female flowers usually fewer than the stamens in male flowers. Ovary 4-8-celled, superior. Fruit a berry seated on the enlarged coriaceous calyx, rind coriaceous, seeds embedded in soft or viscid pulp.

LVI.—Styraceæ. Small trees or shrubs. Leaves alternate, simple, exstipulate. Flowers usually white, regular, 5-merous. Petals free or connate below. Stamens many adnate to the bases of the petals. Ovary inferior, 2-5- usually 3-celled. Fruit drupaceous.

LVII.—Oleaceæ. Shrubs or trees, sometimes twining. Leaves opposite or (*Jasminum humile*) alternate, simple or compound, exstipulate. Flowers regular. Calyx 4-9-toothed, or truncate, rarely (*Fraxinus*) 0. Corolla gamopetalous, 4-10-lobed or (*Fraxinus*) 0. Stamens 2, inserted on the corolla or (*Fraxinus*) hypogynous. Ovary 2-celled, free. Fruit various.

LVIII.—Apocynaceæ. Trees or shrubs, often twining usually with milky juice, sometimes armed. Leaves opposite or whorled, exstipulate. Flowers regular, bisexual, 5-merous. Stamens 5, inserted on the corolla-tube, anthers free or adhering to the stigma, pollen granular. Ovary of 2 distinct or connate carpels, superior. Fruit of 1 or 2 dry or fleshy drupes or of 2 free or connate follicles. Seed often with a tuft of hairs.

LIX.—Asclepiadaceæ. Herbs or shrubs, mostly twining, usually with milky juice. Leaves opposite or wanting, exstipulate. Flowers regular, bisexual, 5-merous. Stamens 5, inserted at the base of the corolla, filaments free or united in a column, anthers free or united into a tube adnate to the stigma, pollen in each cell united into 1 or 2 granular or waxy masses. Ovary of 2 carpels united only by the stigma. Fruit of 1 or 2 follicles. Seed with a tuft of hairs.

LX.—Loganiaceæ. Shrubs, sometimes twining. Leaves opposite, stipules usually represented by a raised line between the petioles. Flowers 4-5-merous, bisexual. Stamens as many as corolla-lobes, inserted on the corolla-tube. Ovary 2-celled. Fruit a capsule or berry.

LXI.—Boraginaceæ. Trees, shrubs or undershrubs. Leaves alternate or opposite, exstipulate. Flowers regular, usually 5-merous. Calyx inferior, persistent in fruit. Stamens inserted on the corolla-tube, as many as corolla-lobes. Ovary 2- or 4-celled, ovules 4. Fruit drupaceous or dividing into nutlets.

LXII.—Convolvulaceæ. Shrubs, suberect or twining. Leaves alternate, exstipulate. Flowers regular, 5-merous. Sepals free or shortly connate, persistent. Corolla often plicate in bud. Stamens 5, inserted on the corolla. Ovary 2- or 4-celled, superior, ovules 2-4. Fruit a capsule or berry.

LXIII.—Solanaceæ. Erect trees, shrubs or undershrubs often armed. Leaves alternate (or falsely opposite), exstipulate. Flowers regular, usually 5-merous. Calyx persistent. Corolla often plicate in bud. Stamens inserted on the corolla. Ovary normally 2-celled, superior. Fruit a berry.

LXIV.—Bignoniaceæ. Trees, shrubs or herbs. Leaves opposite, 1-3-pinnate, exstipulate. Flowers showy, zygomorphic, 5-merous. Corolla, more or less 2-lipped. Stamens 4, didynamous often with a rudimentary fifth or (*Orocyllum*) 5. Ovary 2-celled, superior. Fruit an elongate capsule, seeds winged.

LXV.—Acanthaceæ. Shrubs, undershrubs or herbs, rarely (*Thunbergia*) climbing. Leaves simple, opposite. Flowers usually zygomorphic. Calyx 5-partite or (*Thunbergia*) of several small teeth. Corolla subequally 5-lobed or 2-lipped. Stamens 4 or 2, inserted on the corolla. Ovary 2-celled, superior. Fruit a capsule. Seeds orbicular, compressed.

LXVI.—Verbenaceæ. Trees, shrubs or herbs, sometimes rambling or climbing. Leaves opposite or whorled, simple or (*Vitex*) digitate, exstipulate. Flowers usually zygomorphic usually 4-5-merous. Stamens 4, didynamous or (*Callicarpa*) equal, inserted on the corolla. Ovary usually 4-celled, superior. Fruit drupaceous, or (*Caryopteris*) capsular.

LXVII.—Labiatæ. Shrubs or undershrubs, stem usually quadrangular. Leaves opposite rarely ternate, simple, exstipulate. Flowers usually zygomorphic. Calyx persistent, gamosepalous. Stamens 4 or 2, inserted on the corolla. Ovary 4-lobed or 2-partite, ovules 4. Fruit of dry nutlets.

(c) Monochlamydeæ.

LXVIII.—Nyctaginaceæ. Erect or diffuse herbs or shrubs. Leaves opposite, entire, exstipulate. Flowers bisexual, small, regular. Perianth gamophyllous, petaloid. Stamens 1-5, exserted. Ovary 1-celled, free, ovule 1. Fruit an utricle.

LXIX.—Amarantaceæ. Shrubs, undershrubs or herbs. Leaves opposite or alternate, exstipulate. Flowers usually bisexual, small, in spikes, racemes or heads. Perianth segments, filaments connate below with or without interposed staminodes. Ovary 1-celled, free. Fruit a berry or utricle.

LXX.—Chenopodiaceæ. Undershrubs. Leaves alternate, simple, entire, exstipulate. Flowers minute, unisexual. Perianth-segments 4 in males, wanting in females. Stamens 4, opposite the perianth-segments. Ovary 1-celled, free, ovule 1. Fruit an utricle enclosed in the persistent perianth.

LXXI.—Polygonaceæ. Herbs or shrubs. Leaves alternate, entire, stipules usually sheathing. Flowers small and usually bisexual. Perianth-segments 3-6, persistent. Stamens usually 5-8, opposite the perianth-segments. Ovary 1-celled, free, compressed or trigonous, ovule 1. Fruit a nut, enclosed in the perianth.

LXXII.—Aristolochiaceæ. Twining shrubs or undershrubs. Leaves alternate, exstipulate. Flowers bisexual. Perianth tubular, upcurved, limb broad. Anthers 6 in a ring round the style. Ovary 6-celled; ovules numerous. Fruit a capsule.

LXXIII.—Piperaceæ. Shrubs. Leaves alternate, entire, stipulate. Flowers minute, dioecious, spicate. Perianth 0. Stamens 2-4. Ovary 1-celled, stigmas 2-6. Fruit a berry.

LXXIV.—Lauraceæ. Trees or shrubs. Leaves alternate, rarely opposite, evergreen, entire, exstipulate. Flowers small, regular. Perianth inferior, tube short, lobes usually 6, sepaloid. Stamens in 2-4 whorls, the outer opposite the perianth-segments, the inner usually reduced to staminodes, anthers opening by valves. Ovary 1-celled, free, ovule 1. Fruit a berry.

LXXV.—Thymelaeaceæ. Shrubs. Leaves alternate or opposite, simple, entire, exstipulate. Flowers regular, bisexual. Perianth gamophyllous, petaloid, tubular below, limb 4-5-lobed, lobes imbricate. Stamens twice as many as perianth-lobes, biseriate, inserted on the perianth, the outer opposite its lobes and at a higher level than the inner. Ovary 1-celled, free, ovule 1. Fruit a small berry.

LXXVI.—Elaeagnaceæ. Shrubs or trees, usually thorny. Leaves alternate, entire, clothed beneath with silvery scales or hairs, exstipulate. Flowers small, regular, 4-5-lobed, 2-partite or obscurely 2-lobed. Stamens 4, inserted on the perianth. Ovary 1-celled, free, ovule 1. Fruit a false drupe, succulent.

LXXVII.—Loranthaceæ. Parasitic shrubs. Leaves usually opposite or wanting, entire, thick, exstipulate. Perianth simple or double. Stamens as many as and opposite the perianth-lobes. Ovary inferior, 1-celled, ovule 1. Fruit a berry or drupe, usually viscid.

LXXVIII.—Santalaceæ. Shrubs. Leaves alternate, entire, exstipulate. Flowers minute, polygamous or unisexual, regular. Perianth-limb 3-5- or 6-lobed. Stamens as many as and inserted on and opposite the perianth-lobes. Ovary 1-celled, inferior, ovules 2-4. Fruit a drupe.

LXXIX.—Euphorbiaceæ. Herbs, shrubs or trees, rarely climbing, often with milky juice. Leaves usually alternate, simple or (*Bischoffia*) trifoliate, usually stipulate. Flowers unisexual, usually small. Perianth usually simple and calycine, rarely (*Jatropha*, *Bridelia* and *Andrachne*) double or (*Euphorbia*) 0.

LXXX.—Ulmaceæ. Trees or shrubs, sap watery. Leaves alternate, simple, stipulate. Flowers small, in axillary-clusters or cymes, or females solitary. Perianth simple, segments 4-8. Stamens as many as and opposite the perianth-segments, rarely (*Holoptelea*) twice as many. Ovary superior, usually 1-celled, ovule 1. Stigmas 2, large or style 2- or 4-fid. Fruit a winged nut, drupe or samara.

LXXXI.—Urticaceæ. Herbs, shrubs or trees, sap watery. Leaves opposite or alternate, simple, stipulate. Flowers small, in clusters usually arranged in spikes, cymes or panicles. Perianth simple, segments 4-5, rarely 2 or 3. Stamens as many as and opposite the perianth-segments. Ovary superior, 1-celled, ovule 1. Style simple or none. Fruit an achene usually invested by the dry or fleshy pericarp.

LXXXII.—Moraceæ. Trees or shrubs, with milky latex. Leaves alternate, rarely (some figs) opposite, simple (rarely deeply cut), stipulate. Flowers small, capitate, spiciform or crowded on the outside or inside of fleshy receptacles; females rarely (*Streblus*) solitary or 2-4 together. Perianth simple, segments 2-6. Stamens as many as and opposite the perianth-segments. Ovary superior, 1-celled, ovule 1. Styles 1-2, simple or bifid. Fruit composed of confluent (single in *Streblus*) perianths and often enlarged receptacles.

LXXXIII.—Juglandaceæ.—Trees. Leaves alternate, pinnate, exstipulate. Flowers small, monoecious. Male flowers in catkins. Female flowers in few- or many-flowered spikes. Perianth adnate to the ovary. Ovary inferior, 1-celled, of 2 carpels, ovule 1. Fruit a drupe or nut.

LXXXIV.—Myricaceæ. Small evergreen trees. Leaves alternate, entire, dotted with resin beneath, exstipulate. Flowers minute, unisexual, in cylindric bracteate spikes. Perianth 0. Stamens 3-6. Ovary 1-celled, of 2 carpels, ovule 1. Fruit a drupe.

LXXXV.—Betulaceæ. Deciduous trees. Leaves alternate, simple, stipulate. Flowers monoecious. Male flowers in catkins. Female flowers in small catkins or spikes. Carpels 2. Ovary subinferior, 2-3-celled after fertilisation, ovules 1-2 in each cell. Styles 2. Fruit a nut often winged or enclosed in the enlarged bracts.

LXXXVI.—Fagaceæ. Evergreen trees. Leaves alternate, simple, stipulate. Flowers monoecious. Male flowers in catkins. Female flowers 1-3 together, surrounded by an involucre of bracts. Carpels usually 3-4, rarely 6. Ovary subinferior, 2-3-celled after fertilisation, ovules 1-2 in each cell. Styles 3-4. Fruit of 1 or more nuts surrounded by the enlarged involucre bracts.

LXXXVII.—Salicaceæ. Deciduous trees or shrubs. Leaves alternate, simple. Flowers unisexual, in catkins, each flower in the axil of a bract, perianth 0, disk of 1 or more glands or cup-shaped. Stamens 2 or more, usually free. Ovary 1-celled, placentae 2-4, parietal. Fruit a capsule. Seed cottony.

II.—Monocotyledons.

LXXXVIII.—Liliaceæ. Shrubs or herbs, often climbing, sometimes armed. Leaves alternate or replaced by cladodes, petiole sheathed. Flowers 1- or 2-sexual. Perianth of 6 free segments. Stamens 6. Ovary 3-celled, superior. Fruit a berry.

LXXXIX.—Palmaceæ. Shrubs or trees, often spiny, sometimes climbing, stem solid. Leaves alternate, pinnate or flabelliform. Flowers small in spikes or panicles. Perianth of 6 lobes or segments. Stamens usually 6. Ovary superior, 1-3-celled or of 3 carpels, ovules 1-2 in each cell or carpel. Fruit usually a drupe.

XC.—Araceæ. Suffrutescent climbers. Leaves alternate, often large, simple, entire or lobed, petiole often winged and sheathing. Flowers small on a fleshy spadix surrounded by a conspicuous spathe. Perianth often 0. Stamens 4-6. Ovary 1-2- or 3-celled. Fruit of berries, distinct or confluent.

XCI.—Gramineæ. Stems more or less tufted, woody or herbaceous, hollow, jointed. Leaves linear, lanceolate or oblong, jointed on to a sheath which is amplexicaul and split to the base. Flowers small in spikelets, each flower in the axil of a bract. Perianth much reduced and inconspicuous. Stamens 3 or 6. Ovary 1-celled, superior, ovule 1. Fruit a caryopsis.

B.—Gymnosperms.

XCII.—Gnetaceæ. Shrubs. Leaves reduced to sheaths. Flowers small, unisexual. Male flowers in small bracteate spikes, perianth 2-lobed, anthers 2-8, sessile on a column, 2-celled. Female flowers 1-3 together, bracteate, ovule 1 in each flower, enclosed in a perianth which becomes fleshy in fruit.

XCIII.—Taxaceæ. Evergreen trees. Leaves without resin canals, bifarious, linear, flattened. Flowers unisexual, perianth 0. Male flowers in subglobose axillary catkins. Stamens about 10, peltate. Female flowers reduced to a single ovule, solitary, axillary, seated on a thick disk and surrounded by scales. Fruit drupaceous; seed partially immersed in the succulent disk.

XCIV.—Pinaceæ. Evergreen trees or shrubs. Leaves with resin canals, acicular scale-like or linear and flattened. Flowers unisexual, perianth 0. Male flowers in deciduous catkins. Stamens numerous, scale-like. Female flowers in cones consisting of numerous scale-like flat or peltate carpels. Fruit a woody cone or (*Juniperus*) berry-like; seed not exserted.

A FOREST FLORA FOR KUMAON.

I.—RANUNCULACEÆ.

Annual or perennial herbs or rarely shrubs. Leaves radical or alternate, rarely opposite. Flowers bisexual or unisexual, regular or irregular. Sepals 5 or more, rarely fewer, very rarely persistent, often petaloid, imbricate or rarely valvate. Petals 5 or more or 0, rarely 4 or 3, hypogynous, imbricate, often minute or deformed. Stamens hypogynous, usually numerous in many rows. Anthers adnate, opening laterally or outwards. Carpels numerous, rarely 1, free or rarely coherent; stigma simple; ovules numerous or solitary, on the ventral suture. Fruit of one-seeded beaked or plumose achenes or many-seeded follicles or rarely a capsule or berry.

CLEMATIS, *Linn.*

Climbing shrubs. Leaves opposite, simple or compound, exstipulate, petioles often twining. Flowers solitary or fascicled or paniced, axillary or terminal. Sepals usually 4, petaloid, valvate. Petals 0. Stamens many. Carpels numerous, distinct, with 1 pendulous ovule in each. Fruit a head of sessile or stalked achenes with long, usually feathery styles.

I.—Leaves ternate. Flowers long-peduncled, in axillary fascicles.

- | | |
|--|-------------------------|
| A. Flowers white; sepals spreading, 1-2 inches long | 1. <i>montana</i> . |
| B. Flowers greenish-brown or greenish; sepals erect with recurved tips, not exceeding 1 inch long. | |
| 1. Two connate green bracts forming a cup just below the flower | 2. <i>napaulensis</i> . |
| 2. No bracts | 3. <i>barbellata</i> . |

II.—Leaves bipinnate. Flowers long-peduncled, solitary or in axillary fascicles. 4. *orientalis*.

III.—Leaves ternate or 1- or 2-pinnate. Flowers in panicles.

- | | |
|---|----------------------|
| A. Sepals spreading from the base. | |
| 1. Flowers .5—6 inch diameter | 5. <i>Gouriana</i> . |
| 2. Flowers .6—8 inch diameter | 6. <i>grata</i> . |
| 3. Flowers .8—1 inch diameter | 7. <i>puberula</i> . |

B. Sepals erect with recurved tips.

1. Filaments hairy throughout.

(a) Leaves glabrescent.

* Leaflets 3—7. Leaves more or less connate at the base ... 8. *connata*.

** Leaflets 3. Leaves not connate at the base.

Leaves lanceolate. Filaments with long spreading hairs which envelop the anthers 9. *acuminata*. var. 1.

Leaves ovate. Hairs of filaments not enveloping the anthers ... 9A. *acuminata*. var. 2.

(b) Leaves tomentose.

Leaves and inflorescence tomentose ... 10. *Buchananiana*.

Leaves and inflorescence densely velvety tomentose ... 11. *grewiaeflora*.

2. Filaments hairy only in the lower half ... 12. *nutans*.

I have omitted *C. smilacifolia*, Wall., of which there are no specimens from this area though reported by Messrs. W. J. Lambert and H. G. Champion to occur in Central and East Almora. This species is characterised by simple, cordate-ovate, shining leaves 8—7 inches long, 7-9-nerved at the base, and panicles of brownish flowers 1-1.5 inches diameter.

1. *Clematis montana*, Buch.—Ham.—A deciduous climber with rambling stems attaining 30 feet high and 2 inches diameter. Bark pale yellowish-brown, very rough, exfoliating in long soft fibrous strips. Leaves mostly fascicled on arrested branches, trifoliate. Petiole 1.5—3 inches long. Leaflets 1—3 inches long, ovate or ovate-lanceolate, acuminate, toothed, membranous, glabrescent or rarely hairy, dull green above, somewhat glossy beneath. Flowers white or tinged pink, fragrant, 2-3 inches diameter, on axillary fascicled peduncles usually longer than the leaves. Sepals 1-2 inches long, spreading, membranous, glabrous or silky outside. Filaments glabrous. Achenes glabrous; styles exceeding 1 inch long.

Occurs throughout the hills between 5,000 and 11,500 feet. Common in oak forests. Flowers: April—June.

2. *Clematis napaulensis*, DC. Vern. Kanguli, Jai. (These terms are used indiscriminately for any species of *Clematis*).—An evergreen climber with spreading stems often forming dense masses and attaining 40 feet high and .75 inch diameter. Bark pale brown, rough, exfoliating in loose fibrous strips. Leaves mostly fascicled on arrested branches, trifoliate. Petiole usually 1-2 inches long, sometimes less. Leaflets variable, 1.5—5 by .3—1.2 inches, entire or more or less deeply 3-lobed, sometimes to the base, very membranous, usually lanceolate or linear-lanceolate, acute, glabrous, glossy beneath. Flowers greenish, on axillary fascicled slender drooping peduncles 1-2.5 inches long. Sepals .6-.7 inch long, erect, densely silky-pubescent outside. Filaments glabrous, pink. Anthers lilac. Peduncles with two connate membranous green bracts forming a cup about .25 inch below the flower (.5—.75 inch below

the fruit), sometimes enlarged and foliaceous. Achenes hairy; styles exceeding 1 inch.

Occurs throughout the hills between 4,500 and 7,000 feet. Generally scarce and usually found growing in shady moist ravines. Flowers: December-January. Fruit: April-May.

3. *Clematis barbellata*, Edgew.—A deciduous climber with stems up to 20 feet high and 1 inch diameter. Bark pale brown, very rough, exfoliating in long fibrous strips. Leaves mostly fascicled on arrested branches, trifoliolate. Petiole 1·5—3 inches long, somewhat enlarged at the base and more or less connate on the lengthened shoots. Leaflets 1·5—4 inches long, ovate or ovate-lanceolate, acuminate, more or less coarsely toothed or often incised, membranous, glabrescent, dull green above, very glossy beneath; nerves depressed above and prominent beneath. Flowers greenish-brown, unscented, 1·9—2·2 inches across, on axillary fascicled peduncles 1·5—3 inches long. Sepals erect with recurved tips, 6—1 inch long, thick, softly pubescent on both sides, pale greenish-yellow tinged purplish-brown inside and with a few streaks of the same colour outside, or less frequently almost entirely purplish-brown inside and outside. Filaments usually fringed with long hair. Achenes hairy on the edges and towards the top, otherwise glabrous. Styles 1·5—2 inches long.

Occurs on the central and main ranges between 7,000 and 12,000 feet. Common in *karshu* and silver fir forests on shady aspects. Flowers: May-June.

4. *Clematis orientalis*, Linn.—A deciduous climber with stems up to 3 feet long and ½ inch diameter, only the basal portion persisting. Twigs striate, pubescent at first. Bark rough, fibrous. Leaves bipinnate, 3—6 inches long. Leaflets 3—1 inch long, lanceolate or ovate-lanceolate, more or less deeply 3-lobed or -partite or less frequently entire, acuminate, base narrowed into the petiolule, membranous, pubescent beneath when young, ultimately glabrous or nearly so. Flowers yellowish-brown, 1-1·5 inches diameter, solitary or 2-3 together, terminating arrested axillary shoots which usually bear a few reduced leaves at their apex. Peduncles 3—6 inches long. Sepals greenish-yellow finely mottled with pale purplish-brown, ovate-acuminate, 6—1·1 inches long, glabrous without, pubescent within. Filaments hairy. Achenes hairy. Styles about 1 inch long.

Occurs on the inner dry ranges bordering Tibet between 10,000 and 13,000 feet. It grows on open boulder-strewn ground, the stems spreading over the ground surface or straggling over bushes of *Caragana*, etc. Flowers: July-August. The species described is var. *Kumaonensis*, P. Brühl.

5. *Clematis Gouriana*, Roxb.—A large rambling evergreen climber with stems up to 50 feet high and 3 inches diameter. Bark pale brown,

rough, exfoliating in long thin fibrous strips. Branches furrowed. Leaves pinnate, bipinnate or biternate, usually 6—10 inches long. Leaflets 2·3·5 inches long, ovate oblong or lanceolate, acuminate, entire or distantly toothed, base cordate or rounded, thin but firm, glabrous or pubescent on the nerves beneath. Flowers white or cream-coloured, fragrant, 5·6 inch diameter, in copious axillary and terminal leafy panicles. Sepals spreading 2·3 inch long, ultimately revolute, puberulous, margins tomentose. Filaments glabrous. Achenes hairy. Styles 1·1·5 inches long.

Occurs throughout the Bhabar and outer and central ranges between 1,500 and 4,000 feet elevation. Very common in open miscellaneous forest at the base of the hills. Flowers: August—October. Fruit: December—March.

6. Clematis grata, Wall.—A climber with stems up to 10 feet high and 5 inch diameter. Bark pale brown, rough, peeling off in thin fibrous strips. Leaves pinnate, or a few bipinnate or trifoliate. Leaflets usually 5, 1·5—3 inches long, broadly ovate, acuminate, base rounded or cordate, inciso-serrate, more or less deeply 3-lobed or-partite, villous on both sides or glabrate above. Flowers cream-coloured, fragrant, 6—8 inch diameter, in large terminal leafy panicles, the lower branches usually axillary. Sepals spreading, 25—35 inch long, tomentose outside, caducous. Filaments glabrous. Achenes densely pubescent. Styles 1·1·5 inches long.

Occurs throughout the hills between 3,000 and 8,000 feet elevation. Common, especially at lower elevations in scrub forest. Flowers: August—October.

7. Clematis puberula, H. f. and T.—A climber with slender deeply-grooved stem. Young shoots clothed with adpressed hairs. Leaves pinnate or biternate. Leaflets 5·2 inches long, often very variable on the same leaf, ovate-lanceolate or lanceolate, simple or more or less deeply 3-lobed, entire or remotely toothed, base rounded but not cordate, thin, with scattered hairs on both surfaces especially beneath. Flowers yellow, about 8—1 inch diameter, in lax 3—9-flowered axillary and terminal panicles. Sepals spreading, 4·5 inch long, silky-hairy on both surfaces, margins woolly-tomentose. Filaments glabrous. Achenes silky.

There are no sheets from our area belonging to this species at Dehra Dun, but there are two sheets in the Herbarium at Kew from the Falconer collection, one of which was collected at Ukhimath in North Garhwal at 4,000 feet elevation, the other is simply labelled Garhwal. Flowers probably September-October.

8. Clematis connata, DC.—A deciduous climber with stems 5—10 feet high and up to 1 inch diameter. Stems deeply ribbed. Bark pale yellowish-brown, fibrous. Young shoots striate, glabrous, often purplish with a waxy bloom. Leaves pinnate, 6—12 inches long; petioles more or less connate, the winged portion not more than 25 inch broad.

Leaflets 3—7, distant, 2—6 by 1·5—4 inches, broadly ovate, cordate, acuminate, coarsely serrate, the teeth apiculate, sometimes lobed, glabrous or puberulous above, glabrous or hairy on the nerves beneath, dull green above, glossy beneath; nerves deeply impressed above and prominent beneath. Flowers greenish-yellow, in few- or many-flowered lax axillary panicles 3—9 inches long. Sepals 7-1 inch long, erect with recurved tips, thick, pubescent without and tomentose within. Filaments hairy. Achenes silky. Styles 1·5-2 inches long.

Occurs throughout the central and outer ranges between 7,000 and 9,000 feet (in the Punjab Mr. Parker records in down to 4,000 feet). Fairly common in shady forest but seems to be local. Flowers: August-September.

9. *Clematis acuminata*, DC. var. 1.—A slender climber with stems up to 5 feet high and 3 inch diameter. Twigs ribbed, glabrescent. Leaves trifoliolate, 3—6 inches long, the terminal leaflet nearly twice the size of the lateral. Terminal leaflet 2·5-4 by 7-1·4 inches; all lanceolate or ovate-lanceolate, long-acuminate, base 3—5-nerved and rounded, margin distantly and finely cuspidate-serrate, glabrous above except for a few scattered hairs, glabrous beneath except for a few hairs on the nerves. Flowers creamy-white, unscented, about 6 inch diameter, in few-flowered lax axillary leafy panicles 1·5—4·5 inches long. Sepals 5-6 inch long, erect with recurved tips, thick, with dense short pubescence outside, more or less pubescent inside, ribbed. Filaments with long spreading hairs which envelop the anthers. Achenes densely hairy.

Occurs in the central and outer ranges between 6,000 and 7,000 feet. Probably scarce. It is found in shady cool forest and rocky ravines. Flowers: October—January. Fruit: April. This is subspecies *Wallichii*, H. f. and T. vide P. Brühl in volume V of the Annals of the Royal Botanic Garden, Calcutta.

9A. *Clematis acuminata*, DC. var. 2.—A climber with stems 4—12 feet high and up to 3 inch diameter. Twigs ribbed, pubescent. Leaves trifoliolate, 6—12 inches long. Leaflets variable, usually 2—5·5 by 1—3 inches, broadly ovate or ovate-lanceolate, acuminate, base 3- 7-nerved, rounded or subcordate, margin coarsely toothed, sometimes more or less deeply 3-lobed, glabrescent above, puberulous beneath. Flowers pale greenish-yellow, 1—1·5 inches diameter, in few-flowered lax, often leafy, axillary panicles 4—8 inches long. Sepals 8—1·2 inches long, erect with recurved tips, thick, with dense short pubescence outside, more or less pubescent inside. Filaments with spreading hairs not enveloping the anthers. Achenes pubescent. Styles 1-2 inches long.

Has been collected at Naini Tal where it is common in *banj* and *moru* forest between 6,500 and 7,000 feet. Flowers: September-October. Fruit: April. This plant is subspecies *Sikkimensis*, H. f. and T. var. *Clarkei*, O. Kuntze, vide reference under the preceding species. These two plants, though treated by past authors as varieties only, have very distinctive characters and are, I think, worthy of specific rank.

10. Clematis Buchananiana, DC.—A deciduous climber with stems up to 25 feet high and 1·5 inches diameter. Bark pale brown, rough, exfoliating in long thin fibrous strips. Twigs ribbed, clothed with soft pale tomentum. Leaves pinnate, 6—9 inches long; petioles more or less connate. Leaflets 3—7, 2—4·5 inches long, broadly ovate or suborbicular, cordate, acute or shortly acuminate, coarsely serrate, the teeth apiculate, sometimes 3-lobed, pubescent above, tomentose beneath; nerves deeply impressed above, prominent beneath; base 5-7-nerved. Flowers cream-coloured, heavily scented like orange blossom, in few- or many-flowered axillary and terminal pubescent panicles. Sepals 1·1·6 inches long, erect, rather thick, ribbed, narrowly lanceolate, tomentose on both sides. Filaments hairy. Achenes densely hairy. Styles 2 inches long.

Occurs throughout the hills between 3,000 and 8,000 feet. Often very common in hedges between cultivation, also in open *banj* forest. Flowers: October-November.

11. Clematis grewiaeflora, DC.—Twigs densely tomentose with spreading hairs. Leaves pinnate. Leaflets 3—5, 2—4 inches long, broadly ovate or suborbicular, cordate, acute, undivided or more or less 3- or 5-lobed, serrate, the teeth apiculate, densely tomentose on both surfaces, nerves prominent beneath, base 5-nerved. Flowers in axillary panicles shorter than the leaves, the branches of the inflorescence clothed with very dense short tomentum. Sepals 8·9 inch long, erect, clothed outside with dense short yellow tomentum, tomentose inside. Filaments hairy. Achenes densely hairy.

Has been collected in the East Almora Division where it occurs according to Mr. W. J. Lambert between 2,500 and 6,000 feet. Flowers: November-December.

This species seems to differ principally from *C. Buchananiana* in its parts being more hairy, and I am doubtful whether it is entitled to be regarded as a separate species.

12. Clematis nutans, Royle.—A climber with stems 2—6 feet high and up to 4 inch diameter. Twigs ribbed, silky-pubescent. Leaves pinnate or bipinnate, 4—9 inches long. Leaflets 1—3 inches long, ovate or lanceolate, undivided or 3-5-lobed or -partite, irregularly toothed, rarely entire, silky when quite young, ultimately becoming finely adpressed-hairy on both surfaces. Flowers pale greenish-yellow, about 5 inch long, drooping, in leafy axillary pubescent panicles 2—6 inches long. Sepals pale yellow, erect with recurved tips, 7—9 inch long, thick, densely silky outside, glabrous inside. Filaments hairy only in the lower half. Achenes silky. Styles 6—1·5 inches long.

Occurs along the outer range of hills between 2,000 and 5,000 feet. Fairly common. The leaves are pungent to the taste. Flowers: October—December. Fruit: March.

II.—MAGNOLIACEÆ.

Trees or shrubs, sometimes climbing, often aromatic. Leaves alternate, entire or rarely toothed, usually stipulate. Flowers axillary and terminal, sometimes unisexual, white yellow or red, often showy and fragrant. Sepals and petals similar, hypogynous, very deciduous, arranged in whorls of 3. Stamens very numerous or rarely as few as 5, hypogynous; filaments free or monadelphous; anthers adnate, dehiscent longitudinally. Carpels indefinite, free or cohering to an elongated axis or in one whorl; styles usually short; ovules 2 or more on the ventral suture. Fruit baccate, follicular or of woody dehiscent carpels which are sometimes arranged in a cone.

Trees. Stamens free 1. *Michelia*.

Climbers. Stamens more or less connate 2. *Schizandra*.

1. *MICHELIA*, Linn.

Trees. Leaves evergreen or deciduous, enveloped in bud in their connate, convolute stipules. Flowers solitary, axillary or terminal. Sepals and petals similar, 9—15 or more, in 3 or more rows. Stamens numerous, many-seriate, with flat filaments; anthers adnate, introrse. Carpels in a loose stalked spike; stigma decurrent; ovules 2 or more. Fruit a lax or dense spike of coriaceous dorsally dehiscent carpels.

Leaves ovate-lanceolate tapering to a long acuminate point ... 1. *Champaca*.

Leaves oblong, abruptly short-acuminate 2. *Kisopa*.

1. *Michelia Champaca*. Linn. Vern. *Champa*, Hindi.—A medium-sized or large evergreen tree attaining 5 feet girth and 80 feet high. Bark smooth, pale grey sometimes whitish. Blaze .5 inch, fibrous towards the interior, pale yellow with orange markings towards the exterior, the whole rapidly turning orange-brown on exposure. Leaves 5.5—11 by 2.5—4 inches, ovate-lanceolate tapering to a long acuminate point, margin entire but sinuate, coriaceous, rather glossy, clothed with minute adpressed hairs on both surfaces when young, ultimately glabrous or nearly so above, main lateral nerves 10—18 pairs, prominent beneath. Petiole .75—1.5 inches long, the lower half swollen. Flowers yellow, sweet-scented, 2 inches diameter, axillary. Peduncle stout .15—3 inch long bearing at the apex two ovate, caducous, silky-pubescent bracts 1—1.4 inches long which sheathe the flower-buds and leave an annular

scar below. Fruiting spike 2—4 inches long. Carpels subsessile, 5·6 inch long, oblong, dark brown with pale specks, woody. Seeds scarlet.

Planted round villages and temples throughout the area up to 5,000 feet but not very common. At Bhalaon in the Ramnagar Division it is found growing in ravines in *sal* forest and is either truly wild or has run wild. Flowers: June-July. Fruit: October-November.

2. *Michelia Kisopa*, Ham. Vern. Garūri, NG. Kanjira, EA.—A medium-sized or large evergreen tree attaining 10 feet girth and 125 feet high. Twigs with conspicuous pale circular lenticels, and with slightly raised stipular rings left by the deciduous stipules. Bark pale brown, roughish, exfoliating in small thin corky scales. Blaze 5·1 inch, soft with short fibre, pale yellow rapidly turning orange-brown on exposure. Leaves 3·5—7 by 1·25—2·5 inches, oblong or oblanceolate-oblong, abruptly short-acuminate, base obtuse or acute, entire, coriaceous, densely clothed with minute adpressed pubescence beneath, pubescent above when young but soon becoming glabrous, glossy dark green above, paler and glaucescent beneath; lateral nerves indistinct. Petiole 3—1·5 inches long with two small glands a little above the middle. Flowers yellow, not or scarcely scented, 1·5—2 inches diameter, axillary. Peduncle stout, 1 inch long, bearing at the apex two ovate, caducous, silky-pubescent bracts about 5 inch long which sheathe the flower buds and leave an annular scar below. Fruiting spike 2·3 inches long. Carpels sessile, 3·4 inch long, subglobose, dark brown with pale specks, woody. Seeds black with a dark red covering.

Occurs throughout the hills between 5,000 and 7,000 feet elevation. Sometimes common in dense shady ravines in *banj* forest, but generally scarce. Flowers: September—November. Fruit: October-November.

2. SCHIZANDRA, *Michaux.*

Climbing glabrous shrubs. Leaves exstipulate. Flowers unisexual, axillary or in the axils of scales near the base of short lateral leafy branches. Sepals and petals 9—12, imbricate in about 3 series. Male flowers; stamens 5—15 or more, in a spiral series, filaments very short, free or subconnate, often fleshy; anthers free or subimmersed in a fleshy head of confluent filaments. Female flowers; ovaries many, densely imbricated; stigma sessile; ovules 2. Fruit a spike of indehiscent fleshy 1-seeded carpels.

Deciduous. Flowers white. Petiole pinkish ... 1. *grandiflora*.

Evergreen. Flowers pink. Petiole not pink ... 2. *propinqua*.

1. *Schizandra grandiflora*, Hook. f. and T. Vern. Agāli, NG. Chimgaddi, NG.—A deciduous sinistrorse climber with stems up to 40 feet high and 2 inches diameter. Twigs smooth, reddish-brown with conspicuous pale raised lenticels. Bark rough dark brown. Blaze

·3·4 inch, pink, soft, fibrous. Leaves 3·5—7 by 1·5—3·5 inches, elliptic-ovate to oblong-lanceolate, acuminate, entire or with small distant glandular teeth, rather soft and fleshy, somewhat glossy above when mature, glabrous. Petiole ·5—1·5 inches long, pinkish, fleshy, deeply grooved above. Flowers 1—1·8 inches diameter, waxy-white, the outermost whorl often tinged pink or green, dioecious, fragrant, on drooping axillary peduncles ·5—1·5 inches long. Fruit a drooping spike 5—12 inches long with numerous carpels attached to the swollen axis. Carpels sessile, ·2—·4 inch long, ovoid, red, containing 1 or 2 brown seeds embedded in a juicy pulp.

Occurs throughout the hills between 6,000 and 10,000 feet. Common in *banj*, *telunj*, *karshu*, and silver fir forests. Flowers : May-June. Fruit : September—November.

2. *Schizandra propinqua*, Hook f. and T. Vern. *Agāli*, NG.—An evergreen sinistrorse climber with stems up to 30 feet high and 2 inches diameter. Twigs reddish-brown with prominent distant circular pale lenticels. Bark very rough and often corky, dark brown. Blaze ·25—·35 inch, pink, soft, fibrous. Leaves 3·5-7 by 1·2-2·5 inches, lanceolate or sometimes oblong or elliptic, acuminate, entire or with small distant glandular teeth, coriaceous, dark green above, pale and somewhat glaucous beneath, glossy above when young, glabrous. Petiole ·3—·7 inch long, channelled. Flowers ·5-1 inch diameter, salmon-pink or greenish tinged pink, with a prominent staminal column, all parts of the flower containing a sticky juice. Stamens connate into a fleshy head, salmon-pink. Flowers usually solitary sometimes two together, axillary. Peduncle ·15—·4 inch long. Fruit a drooping spike ·5—3 inches long with numerous carpels attached to the stout axis. Carpels sessile, ·3 inch diameter, globose, red, containing 1 or 2 reniform seeds embedded in a juicy pulp.

Occurs throughout the hills between 4,000 and 6,000 feet. Fairly common in *banj* forest. Flowers : May-June. Fruit : October-November.



III.—ANONACEÆ.

Trees or shrubs often climbing and frequently aromatic. Leaves alternate, simple, entire, exstipulate. Flowers 2- or 1-sexual. Sepals 3 or rarely 2, free or connate. Petals 6, usually thick and fleshy, generally biseriata, hypogynous, valvate or slightly imbricate, the inner sometimes absent. Stamens usually many; filaments short or 0; anthers adnate; connective produced into an oblong or truncate head. Carpels numerous or rarely few or solitary, distinct or rarely coherent; styles short or 0; ovules one or more. Fruit of 1 or more, sessile or stalked, 1- or many-seeded, usually indehiscent carpels or rarely of several coherent carpels.

MILIUSA, *Leschen.*

Trees or shrubs. Flowers 1-2-sexual, green or red, axillary or extra-axillary, solitary fascicled or cymose. Sepals 3, small, valvate. Petals 6, valvate, in 2 series; outer smaller, like the sepals; inner cohering when young by the margins, at length free. Torus elongated, cylindric. Stamens definite or indefinite; anthers subdidymous. Ovaries indefinite; ovules usually 1-2. Fruit a ring of globose or oblong 1-many-seeded carpels.

Miliusa velutina, *Hook f. and T. Vern. Döm-sal*, R.—A small deciduous tree attaining 3 feet girth and 35 feet high. Twigs tomentose. Bark dark brown or blackish, rather rough, more or less deeply furrowed. Blaze .6—1.2 inches, crisp with short coarse fibre, purplish-brown speckled or banded with pale yellowish-brown, juice turning blue on the blade of a knife. Leaves variable, 3—12 by 2—6 inches, ovate or ovate-oblong, acute or acuminate, softly tomentose on both sides, base rounded or slightly cordate. Petiole .1—.25 inch long. Flowers yellowish green, .7—1.4 inches diameter, in few-flowered leaf-opposed cymes. Pedicels 2—4 inches long, drooping, villous. Sepals .15 inch long, ovate, densely brown-tomentose outside. Outer petals similar to the sepals, the 3 inner .5—.9 inch long, ovate, thick, silky-pubescent outside. Stamens numerous. Filaments short. Fruit of a number of black, ellipsoid, stipitate carpels, .6—.75 inch long. Stipe .3 inch long, woody.

Occurs throughout the subhimalayan tract and in the outer hills up to 3,000 feet. Very common in *sal* and miscellaneous forest in the Bhabar. Flowers: April—June, with the young leaves. Fruit: June-July.

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IV.—MENISPERMACEÆ.

Climbing or twining shrubs or occasionally herbs, or very rarely erect shrubs or small trees. Leaves alternate, simple or rarely compound, entire or lobed, often peltate, exstipulate. Flowers dioecious or polygamous, small. Sepals 6 in 2 whorls, or 9—12 in 3—4 whorls, rarely fewer than 6. Petals usually 6 in 2 whorls. Male flowers: stamens usually of the same number as and opposite to the petals; filaments free or connate. Female flowers: staminodes 6 or 0; ovaries 3 or sometimes 1, rarely 6—12; ovules generally solitary. Ripe carpels drupaceous, with the style-scar subterminal, or (by eccentric growth) near the base.

I.—Leaves not peltate.

- | | | | |
|--|-----|-----|-----------------------|
| 1. Leaf-base not or slightly cordate. Main basal nerves 3 or 5 | ... | ... | 1. <i>Cocculus</i> . |
| 2. Leaf-base deeply cordate. Main basal nerves 5—9 | ... | ... | 2. <i>Tinospora</i> . |

II.—Leaves, peltate.

- | | | | |
|-------------------------|-----|-----|-------------------------|
| 1. Whole plant glabrous | ... | ... | 3. <i>Stephania</i> . |
| 2. Tomentose | ... | ... | 4. <i>Cissampelos</i> . |

1. COCCULUS, DC.

Climbing or straggling or erect shrubs, or even trees. Flowers paniced or rarely fascicled in the axils of the leaves. Sepals 6 in 2 series, the outer smaller. Petals 6, smaller than the sepals, usually auricled at the base. Male flowers; stamens embraced by the petals; anthers bursting transversely. Female flowers; staminodes 6 or 0; ovaries 3—6; styles usually cylindric. Drupes compressed; endocarp horseshoe-shaped, dorsally keeled and tubercled, sides concave but not reduced to a thin flat septum.

- | | | | |
|-----------------------|-----|-----|-------------------------|
| A shrub or small tree | ... | ... | 1. <i>laurifolius</i> . |
| A slender climber | ... | ... | 2. <i>villosus</i> . |

1. **Cocculus laurifolius**, DC. Vern. *Tilphara*, Gen.—A large evergreen shrub or small tree, attaining 4 feet girth and 20 feet high. Twigs smooth, green, glabrous except in the leaf axils. Bark slightly rough mainly owing to the presence of numerous small raised circular lenticels, pale brown. Blaze 1—3 inch, white. Leaves 3—6 by 1—1.75 inches, lanceolate or elliptic-lanceolate, entire, glabrous, glossy dark green above, pale and glossy beneath, with 3 strong basal nerves distinctly pale above. Petiole 2—5 inch long, flattened on the upper

surface. Flowers minute, yellowish, in pedunculate capitate cymes .2—3 inch long, solitary and axillary, or arranged in axillary panicles up to 2 inches long. Drupe .2—25 inch diameter, globose, shining, black and juicy, containing a single seed.

Occurs throughout our area between 1,000 and 5,000 feet. Common bordering streams and in shady open ravines in the hills. Flowers: April-May. Fruit: October—January.

2. *Cocculus villosus*, DC. Syn. *C. hirsutus*, Diels.—A slender climber. Twigs densely grey-tomentose. Leaves variable in size up to 3 by 2 inches, ovate or ovate-oblong, obtuse or retuse, apiculate, base rounded or slightly cordate, softly tomentose on both sides but ultimately glabrescent, entire or rarely lobed or toothed. Petiole .1—5 inch long. Flowers minute; male in axillary short-peduncled small capitate cymes; female in axillary clusters of 1—3. Inflorescence villos. Drupe .2 inch diameter, dark purple.

There is a single specimen in the Dehra Dun herbarium from this area. It is labelled "near Hawalbagh, Kumaun." It is likely to occur in the Bhabar tract and outer hill ranges between 1,000 and 2,000 feet. Flowers: February-March.

2. TINOSPORA, Miers.

Climbing shrubs. Flowers in racemes or rarely panicles, axillary or terminal or from the old wood. Sepals 6, in two series, the inner larger. Petals 6, smaller. Male flowers: stamens 6, free; anthers bursting longitudinally. Female flowers: staminodes 6, clavate; ovaries 3; stigmas forked. Drupes ventrally flat, dorsally convex, round or oval; endocarp rugose or tubercled, dorsally keeled, ventrally concave.

Tinospora malabarica, Miers. Vern. *Gileh*, NG. *Gureh*, EA. *Gurja*, R.—A deciduous climber with rambling or dextrorse stems up to 2.5 inches diameter and 70 feet high, often producing very long slender tough and unbranched aerial roots which hang down from the branches. Bark pale brown often yellowish, smooth, peeling off in thin papery pieces, a bright green layer beneath the thin outer bark, with large scattered wart-like lenticels. Young shoots green with pale pubescence. Leaves 3—8 by 3—7 inches, orbicular or broadly ovate, acute or acuminate, rarely retuse, entire, base deeply cordate, rather thick, dull dark green above, clothed on both surfaces with pale short and soft pubescence, venation prominent beneath, base palmately 5—7-nerved. Petiole 3—9 inches long, pubescent, terete, swollen towards the base. Flowers dioecious, greenish-yellow, .2—4 inch diameter, with a rather disagreeable smell, arranged in glabrous or puberulous simple racemes .5—4 inches long, the female somewhat longer than the male. Racemes 1—5 together in clusters on the leafless stems. Pedicels .15—3 inch long, usually solitary in the female, in fascicles of

1—4 in the male. Outer sepals concave; inner flat. Petals spathulate, less than 1 inch long. Drupes 1—3, ellipsoid, 3—4 inch long, first yellow then red; endocarp with a prominent dorsal keel and irregular wart-like tubercles, surrounded by a sticky mucilage.

The species here described has usually been referred to *T. cordifolia*. Miers, which however differs in having smaller glabrous leaves, concave inner sepals and a smooth endocarp, except for the raised dorsal ridge. *T. malabarica* is common throughout the area up to 3,500 feet. Flowers: March-April. Fruit: May while still leafless.

3. STEPHANIA, *Lour.*

Climbing shrubs. Leaves often peltate. Heads of flowers in axillary stalked umbels or, rarely, solitary or cymose. Male flowers: sepals 6—10, free, ovate or obovate; petals 3—5, obovate, fleshy; anthers 6, on the rim of the flattened top of the staminal column, bursting transversely. Female flowers: sepals 3—5; petals as in the male; stamindes 0; ovary 1; style 3—6-partite. Drupe glabrous; endocarp compressed, horseshoe-shaped, dorsally tubercled, sides concave, perforated.

I.—Flowers greenish-yellow. Leaves orbicular ... 1. *glabra*.

II.—Flowers purplish. Leaves triangular—

1. Leaves orbicular-deltoid, obtuse ... 2. *gracilentia*.

2. Leaves triangular-ovate, acuminate ... 3. *elegans*.

1. *Stephania glabra*, *Miers*. Vern. *Gindāru*, NG.—A glabrous dextrorse climber with spreading stems usually 5—10 feet high but attaining 20 feet. Annual shoots smooth, green, terete with a glaucous bloom, attaining 3 inch diameter. Persistent portion of stem nil or up to 10 feet long and 1.5 inches diameter. Bark rough, pale brown. Leaves 3.5—9 by 3—8 inches, broadly ovate or orbicular, thin, margin often sinuate, pale and glaucous beneath, peltate with 9—13 main nerves radiating from the base. Petiole 3—7 inches long. Flowers greenish-yellow, 1 inch diameter, in simple or compound axillary long-peduncled umbels. Peduncles .5—2.5 inches long, solitary or rarely two together. Drupe rounded, laterally compressed, 2—2.5 inch diameter, glabrous, first green, then yellow and finally bright shining red. Endocarp with 15—21 transverse ridges.

Occurs throughout the hills between 3,000 and 6,000 feet. The stem arises from a large underground rounded tuber up to 9 inches across. Flowers: June—August. Fruit: October—December.

2. *Stephania gracilentia*, *Miers*.—A glabrous dextrorse climber with slender annual stems 2—3 feet high, the basal portion of which is often creeping and perennial, but more herbaceous than woody. Leaves 2—3.5 inches long and broad, orbicular-deltoid, obtuse, thin, entire, pale beneath, peltate with 8—9 main nerves radiating from the base. Petiole 1.5—5 inches long. Flowers pale pinkish-purple, 1 inch diameter, in

axillary long-peduncled solitary umbels. Peduncle filiform, .5—1.5 inches long. Drupe .3—.35 inch diameter, globose, glabrous, juicy and red when ripe. Endocarp with 5—10 transverse ridges.

Occurs in the hills between: 6,000 and 8,000 feet. It is common at Naini Tal in moru forest. Flowers: July-August. Fruit: September-October.

3. *Stephania elegans*, Hook. f. and T.—A glabrous dextrorse climber with stems 2—10 feet high and attaining .2 inch diameter, scarcely woody. Twigs smooth, green, terete. Leaves 2—4.5 by 1.5—2.5 inches, triangular-ovate, acuminate, entire, thin, pale beneath, peltate with 7—9 main nerves radiating from the base. Petiole .7—2 inches long. Flowers purplish-red, .1 inch diameter, in axillary long-peduncled solitary umbels. Peduncle slender 1—2.5 inches long. Drupe .3—.35 inch diameter, pink or red when ripe, juicy. Endocarp with 5—10 transverse ridges.

Occurs on the central and inner ranges between 3,500 and 6,000 feet. Fairly common in shady moist ravines in forest. Flowers: August-September. Fruit: November-December.

4. *CISSAMPELOS*, Linn.

Suberect or twining shrubs. Leaves often peltate. Male flowers: cymose; sepals 4, rarely 5 or 6; petals 4, connate, forming a 4-lobed cup; anthers 4, connate round the flattened top of the staminal column, bursting horizontally. Female flowers: racemed, crowded in the axils of leafy bracts; sepals 2 (or sepal and petal 1 each), adnate to the bracts; staminodes 0; ovary 1; style short, 3-fid or 3-toothed. Drupe ovoid; endocarp horseshoe-shaped, compressed, dorsally tubercled, sides excavated.

***Cissampelos Pareira*, Linn. Vern. Pahāri, NG.**—A deciduous dextrorse climber up to 15 feet high, but usually much less. Annual shoots up to .2 inch diameter, wiry, green, softly pubescent or tomentose. Perennial woody portion nil or up to 5 feet long and .75 inch diameter. Bark fairly smooth, pale brown. Leaves 1—4 inches diameter, orbicular deltoid or broadly ovate, base cordate or truncate, usually obtuse, mucronate, pubescent or tomentose on both sides but ultimately glabrous, usually peltate with 5—7 main basal nerves. Petiole 1—3.5 inches long, pubescent. Flowers minute, greenish-yellow. Male flowers in pedunculate branched cymes clustered in the leaf-axils or on long axillary shoots with small leaves and small axillary cymes. Female flowers clustered in the axils of orbicular bracts arranged in long axillary dense racemes. Drupe .2 inch diameter, globose, compressed, hairy, orange-red. Endocarp with transverse ridges.

Occurs throughout the area up to 6,000 feet. Very common in scrub forest, and in hedges. Flowers: June-July. Fruit: October-November.

V.—BERBERIDACEÆ.

Glabrous herbs or shrubs, sometimes climbing. Leaves simple or compound, rarely stipulate. Flowers hermaphrodite or rarely diclinous, regular, axillary, solitary or in simple or compound racemes, usually yellow or white. Sepals often petaloid, 3—9, in 1—3 whorls. Petals equal in number to the sepals or twice as many, and, like them, caducous. Stamens 4—8, usually 6, opposite to the petals; filaments free or connate; anthers bursting by two apical valves or longitudinally. Carpels 1—3, rarely more, distinct; stigma usually peltate. Fruit of 1—3 berries or capsules, usually indehiscent.

I.—Erect shrubs.

- | | | | | |
|-------------------|-----|-----|-----|----------------------|
| 1. Leaves simple | ... | ... | ... | 1. <i>Berberis</i> . |
| 2. Leaves pinnate | ... | ... | ... | 2. <i>Mahonia</i> . |

II.—Climbers

- | | | | |
|-----|-----|-----|------------------------|
| ... | ... | ... | 3. <i>Holboellia</i> . |
|-----|-----|-----|------------------------|

1. BERBERIS, *Linn.* (The *Barberries*.)

Erect shrubs with yellow wood. Leaves simple, alternate or fascicled in the axils of 3—5-partite or rarely simple spines, entire or more often spiny-toothed. Flowers small, yellow, solitary, fascicled, or in bracteate simple or compound racemes. Sepals 6, petaloid, imbricate in two whorls. Petals 6, imbricate in two whorls, usually with 2 glands inside at the base. Stamens 6, free, dehiscing by ascending valves. Carpel 1. Fruit a berry, blue or red.

A. Ripe fruit red.

- | | | | |
|---|-----|------------------------|-------------------------|
| 1. Inflorescence a panicle | ... | ... | 1. <i>Koehneana</i> . |
| 2. Inflorescence a simple raceme. | | | |
| (a) Leaves usually toothed, dull green beneath. | | | |
| (i) Lower pedicels .3—1 inch long | ... | 2. <i>petiolaris</i> . | |
| (ii) Lower pedicels .1—2 inch long | ... | 3. <i>Zabeliana</i> . | |
| (b) Leaves usually quite entire glossy beneath | | 4. <i>affinis</i> . | |
| 3. Inflorescence subcorymbose or subumbellate | | | |
| (i) Leaves .2—9 inch broad | ... | 5. <i>umbellata</i> . | |
| (ii) Leaves .15—25 inch broad | ... | 6. <i>Lamberti</i> . | |
| 4. Flowers solitary | ... | ... | 7. <i>kumaonensis</i> . |

B. Ripe fruit blue-black.

- | | | | |
|---|----------------------|-----------------------------|--|
| 1. Inflorescence a simple raceme. | | | |
| (a) Leaves glossy green not glaucous beneath | 8. <i>aristata</i> . | | |
| (b) Leaves pale glaucous beneath. | | | |
| (i) Leaves .5—1.5 inches broad. Secondary nerves prominent above | ... | 9. <i>asiatica</i> . | |
| (ii) Leaves .3—7 inch broad. Secondary nerves not prominent above | ... | 10. <i>Lycium</i> . | |
| 2. Inflorescence subumbellate | ... | 11. <i>pseudumbellata</i> . | |
| 3. Inflorescence paniculate | ... | 12. <i>Chitria</i> . | |
| 4. Flowers solitary, or fascicled 2—3 together | ... | 13. <i>Osmastonii</i> . | |

1. **Berberis Koehneana**, C.K. Schn.—An erect shrub 4–6 feet high. Twigs reddish, glabrous. Spines 1–3-branched. Leaves 1.5–2 by 3–6 inch, obovate-oblong or oblanceolate, tip rounded and mucronate, base gradually narrowed, entire or with a few small spinous teeth, pale beneath and papillose. Petiole 0–1 inch long. Inflorescence a lax-branched panicle, usually pedunculate, 2–4 inches long. Peduncle and branches slender. Pedicels 1.5–4 inch long, slender. Bracts 1 inch long. Fruit 3–4 inch long, ovoid, red, with no style.

Occurs around Budhi, Byans in the Kali valley, East Almora, between 8,000 and 9,500 feet. Flowers: July-August.

2. **Berberis petiolaris**, Wall. Syn. *Berberis vulgaris*, Linn., var 1. *vulgaris* proper. F.B.I. = *B. pachyacantha*, Koehne. Vern. *Chuntara*, *Chothra*, *Kingora* and *Kilmora*. (These names are used in Garhwal for any species of *Berberis*).—A large deciduous shrub up to 20 feet high and stems up to 6 inches diameter. Bark rough, pale grey or brown. Blaze bright yellow. Twigs glabrous, reddish-brown. Spines usually simple on the twigs, often 3-branched lower down. Leaves 1.5–5 by 7–1.5 inches, obovate or oblong-lanceolate, thin, membranous, closely but rather irregularly toothed or entire, rather abruptly narrowed towards the base which then gradually tapers to a long point, dull green above and below, not glaucous beneath. Petiole variable, but sometimes distinct up to 1.5 inches. Inflorescence a simple, lax, glabrous, pendulous raceme 1–2.5 inches long. Lower pedicels 3–1 inch long. Fruit 3–4 inch long, oblong, red; style very short.

Occurs on the slopes of the main Himalayan range between 8,500 and 11,500 feet. Appears to be local and rather scarce. It is found in *karshu* and silver fir forest. My specimens numbers 626, 627 and 661 are taken as belonging to this species. Flowers: May-June. Fruit: October-November.

3. **Berberis Zabeliana**, C. K. Schn.—A deciduous shrub 4–8 feet high with stems up to 1 inch diameter. Twigs glabrous. Spines 0 or 1–3-branched, usually 3-branched. Leaves 1–3.5 by .5–1.5 inches, obovate or oblong-lanceolate, finely cuspidate-serrate, rather abruptly narrowed towards the base which then gradually tapers to a point, reticulate, dull green above, pale and scarcely glaucous beneath. Petiole variable but sometimes distinct up to .75 inch. Inflorescence a simple glabrous stiff raceme .5–2 inches long. Lower pedicels 1–2 inch long. Fruit 4–5 inch long, oblong, red; style very short.

Has been collected above Dhanpur in Central Garhwal where it is found between 9,000 and 9,500 feet in *karshu* forest. Probably scarce. My specimen number 1094 is taken as belonging to this species. Flowers: May. Fruit: October-November.

4. **Berberis affinis**, Don. Syn. *B. coriaria*, Royle.—A deciduous shrub 4–10 feet high with stems up to 1.5 inches diameter. Twigs pale

straw-coloured, glabrous. Spines 0 or 1—3-branched, strong. Leaves 1—2·5 by ·35—7 inch, oblanceolate, usually with an apiculate apex, base gradually narrowed, entire or rarely with a few cuspidate teeth, glabrous, with strong reticulate nerves, unglossed green above, glossy and not glaucous beneath. Petiole 0—1 inch long. Inflorescence a simple raceme 1—2 inches long, the lower branches rarely producing 2 or 3 flowers in vigorous specimens. Pedicels stout, ·15—·3 inch long. Fruit ·4—·5 inch long, oblong, red; style short.

Occurs along the main Himalayan range between 9,000 and 11,000 feet. Fairly common in open *karshu* forest on warm aspects. Flowers: May-June. Fruit: November.

5. *Berberis umbellata*, Wall, including *Berberis Jaeschkeana*, C. K. Sch. Syn. *B. Garhwalensis*, C. K. Sch.—A small deciduous shrub usually 2—4 feet high but attaining 8 feet with stems up to 1 inch diameter. Twigs and young shoots often reddish, glabrous. Leaves variable ·5—2 by ·2—·9 inch, obovate oblanceolate or spatulate, entire or spinous-serrate, glabrous, dull green above, dull pale and glaucous beneath. Petiole 0—2 inch long. Inflorescence subcorymbose, few-flowered, 1—1·5 inches long. Peduncle 0—1 inch long. Pedicels ·3—7 inch long. Fruit oblong, ·4—·6 inch long, bright red, with no style.

Occurs on the main Himalayan range and interior dry ranges from 9,000 to 12,000 feet. It is a common gregarious shrub forming patches in openings in *karshu* or blue pine forest or scattered over bare southern aspects above forest level. At high elevations it is reduced in all its parts, and these forms correspond with *B. Jaeschkeana*, C. K. Sch. The leaves turn bright orange and scarlet before falling. Flowers: May-June. Fruit: October-November.

6. *Berberis Lamberti*, Parker.—A dwarf shrub with erect stems 2—2·5 feet high. Twigs pale yellowish, glabrous. Spines 1—3-branched, slender, shorter than the leaves. Leaves ·6—1 by ·15—·25 inch, linear-lanceolate, entire, tip terminating in a sharp spine, margin involute, base gradually narrowed, sessile, undersurface pale and glaucous not papillose, the nerves plainly visible. Inflorescence long peduncled, subumbellate or in very short racemes. Peduncle ·5—1·5 inches long, slender. Pedicels ·2—·5 inch long. Fruit ·4 inch long, ovoid, red, with no style.

Has been found in the East Almora Division at Humdhura and Ratapani in Johar by Mr. W. J. Lambert after whom the plant was named. It was seen between 8,500 and 9,500 feet. Fruit: October.

7. *Berberis kumaonensis*, C. K. Schn.—A subdeciduous dwarf shrub with stiff erect stems 6—9 inches high and up to ·25 inch diameter. Twigs glabrous. Spines 2- or 3-branched, usually exceeding the leaves. Leaves ·3—·75 by ·2—·4 inch, oblanceolate obovate or

orbicular, with 2—6 sharp spinous teeth or rarely entire, veins prominent, glabrous, sessile. Flowers solitary. Peduncle .3—.5 inch long. Fruit .3—.4 inch long, ovoid, red, with no style.

Occurs on the slopes of the main Himalayan range between 9,000 and 12,000 feet elevation. It is found on exposed open grassy or rocky slopes usually on south aspects and it tends to form small dense gregarious patches a few feet across. Flowers: June—August.

8. *Berberis aristata*, DC. Syn. *B. aristata*, var. *floribunda*, F.B.I.—A large deciduous shrub usually 6—12 feet high but attaining 15 feet with stem 8 inches diameter. Twigs whitish or pale yellowish-brown. Bark pale brown, closely and rather deeply furrowed, rough. Blaze .2—.3 inch, bright yellow with coarse reticulate fibre. Leaves 1.5-4 by .6-1.3 inches, obovate or elliptic, entire or spinous-toothed, base gradually narrowed, with prominent reticulate nerves, glossy dark green above, glossy pale green but not glaucous beneath. Petiole 0 or distinct up to .15 inch. Inflorescence a simple drooping raceme 1—3 inches long, dense-flowered. Pedicels stout .15—.25 inch long. Fruit .3—.4 inch long, ovoid, blue-black with a thick pale bloom; style distinct.

Occurs throughout the hills between 6,000 and 10,500 feet. Common in openings in forest on warm aspects, frequently in secondary growth. It often forms gregarious patches. Flowers: April—June. Fruit: September—November.

9. *Berberis asiatica*, Roxb. Vern. *Kilmoru*, RK and EA.—An evergreen shrub 4—6 feet high and stem up to 4 inches diameter. Bark rough, furrowed and somewhat corky. Twigs glabrous or shortly pubescent, pale yellowish. Leaves 1—2.5 by .5—1.5 inches, oblong, elliptic or broadly obovate, usually with large distant spinous teeth, sometimes entire, very coriaceous, dark green with very prominent primary and secondary pale reticulate venation above, glaucous beneath. Petiole 0 or distinct up to .4 inch. Inflorescence a simple raceme up to 1.2 inches long, often with a few long-stalked flowers at the base. Pedicels .15—.4 inch long, slender, often glaucous. Fruit .3—.4 inch long, ovoid, blue-black with glaucous bloom; style distinct.

Occurs throughout the hills between 2,000 and 8,500 feet. Common in open forests of *banj* or *chir*, and often abundant and gregarious on waste lands near cultivation. Flowers: March-April. Fruit: May-June.

10. *Berberis Lycium*, Royle.—An evergreen shrub usually 4—6 feet high, but attaining 12 feet high and 4 inches diameter. Twigs pale yellowish, glabrous or minutely pubescent. Bark rough and rather deeply furrowed. Blaze .2 inch, bright yellow with coarse reticulate fibre. Leaves 1—3 by .3—.7 inch, lanceolate or narrowly obovate-oblong, coriaceous, entire or with a few large spinous teeth, dull green above, pale and glaucous beneath, secondary nerves not prominent on the upper surface. Petiole 0 or distinct up to .1 inch. Inflorescence a simple raceme .5—1.5 inches long, often with a few long-stalked

flowers at the base. Pedicels slender, green, '2—'5 inch long. Fruit ovoid, '3 inch long, blue; style distinct.

Occurs in Garhwal and also in the Ranikhet Division, but has not been found in the other divisions. In Garhwal it is a fairly common shrub on waste ground and in secondary scrub near cultivation. It is found between 2,500 and 8,500 feet. Flowers: March—May.

11. *Berberis pseudumbellata*, Parker.—A deciduous shrub 5—12 feet high with stems up to 2 inches diameter. Twigs glabrous, sometimes glaucous and often deep reddish-brown. Leaves '6—1'5 by '35—'6 inch, obovate or spatulate, entire or rarely spinous-serrate, base gradually narrowed, apex rounded and sometimes mucronate, glabrous, membranous, dull green above, pale dull glaucous green beneath. Petiole sometimes distinct up to '4 inch. Inflorescence sub-umbellate, 3—7-flowered. Peduncle up to '5 inch long. Pedicels slender '2—'6 inch long. Fruit '3 inch long, ovoid, blue-black with glaucous bloom; style 0.

Occurs on the dry interior ranges of North Garhwal in the vicinity of Laung and Malari. It is found in blue pine forest as well as in open dry scrub. Flowers: May-June.

12. *Berberis Chitria*, Lindl. Syn. *B. aristata*, var. 1. *aristata* F.B.I. Vern. *Chētar*, RK.—A subdeciduous shrub usually 6—10 feet high but attaining 15 feet high with stem 6 inches diameter. Bark rough and rather deeply furrowed. Blaze '3—'4 inch, bright yellow with coarse reticulate fibre. Twigs finely pubescent, often deep reddish. Spines 1—3-branched, usually simple. Leaves usually 1—2'5 by '4—'8 inch, oblanceolate or narrowly obovate, entire or with distant small spinous teeth, venation rather indistinct, somewhat glossy on both surfaces. Petiole 0 or distinct up to '2 inch. Flowers in drooping panicles up to 4 inches long, usually unbranched in the lower half. Peduncle slender, glabrous, red. Branches and pedicels red. Fruit oblong, narrowed at both ends, '4—'5 inch long, the tip often turned to one side, blue-black without bloom; style distinct.

Occurs throughout the hills between 5,000 and 10,000 feet. A common shrub in *banj* forest, often growing under fairly dense shade. Flowers: May-June. Fruit: September—November.

13. *Berberis Osmastonii*, Dunn.—A dwarf shrub with erect or suberect stems 6—12 inches high and up to '2 inch diameter. Twigs pale yellowish, glabrous. Spines usually 3-branched, slender, often much exceeding the leaves. Leaves '4—1'2 by '1—'3 inch, linear or narrowly oblanceolate, entire or rarely with one or two spinous teeth in the upper half, tip terminating in a sharp spine, margin involute, thickly coriaceous, whitish and densely papillose beneath, no nerves visible on the undersurface even when dry. Petiole 0—'05 inch long. Flowers solitary or 2—3 together, fascicled on the dwarf side shoots. Peduncle

·1—·5 inch long. Fruit ·3—·4 inch long, ovoid, blue-black with glaucous bloom; style distinct.

Occurs on the slopes of the main Himalayan range between 7,500 and 9,000 feet. It is found in cypress forest and on bare south aspects and open rocky ground, but is scarce. It tends to form small gregarious patches. Flowers: April. Fruit: October—December.

2. MAHONIA, Nutt.

Characters of *Berberis* but leaves pinnate with opposite leaflets, and stamens usually 2-toothed below the anther.

Mahonia nepalensis, DC. Syn. *Berberis nepalensis*, Spreng. Vern. *Gurm*, NG. *Haldia*, NG. *Bankhilmana*, RK.—An evergreen shrub 4—10 feet high with sparingly-branched erect stems up to 8 inches diameter. Bark pale brown, rough and corky. Blaze bright yellow. Leaves pinnate, 7—18 inches long, approximate at the ends of the stout twigs. Leaflets usually 7—17, 1·5—4 inches long, ovate or lanceolate, acuminate, base of lateral pairs very oblique, margin coarsely and sharply spinous-toothed, coriaceous, glabrous, shining above, with 3—5 basal nerves prominent beneath. Flowers yellow, ·2—·25 inch long, sweet-scented, in dense erect racemes 2—5 inches long fascicled at the tips of the branches. Pedicels ·05—·15 inch long. Berries ·2—·4 inch long, ovoid, blue-black, glaucous; style distinct.

Occurs throughout the central and inner ranges between 6,000 and 8,000 feet. Fairly common in moist shady oak forest. Flowers: March-April. Fruit: May-June.

3. HOLBOELLIA, Wall.

Climbing shrubs. Leaves digitate. Flowers monoecious in axillary fascicled racemes. Sepals 6, biseriate; 3 outer valvate. Petals 6, minute. Ovaries 3; ovules many. Fruit of 1—3 many-seeded berries.

Terminal leaflet 1—3 inches broad. Leaflets 3—5 1. *latifolia*.

Terminal leaflet ·6—1 inch broad. Leaflets 5—9 2. *angustifolia*.

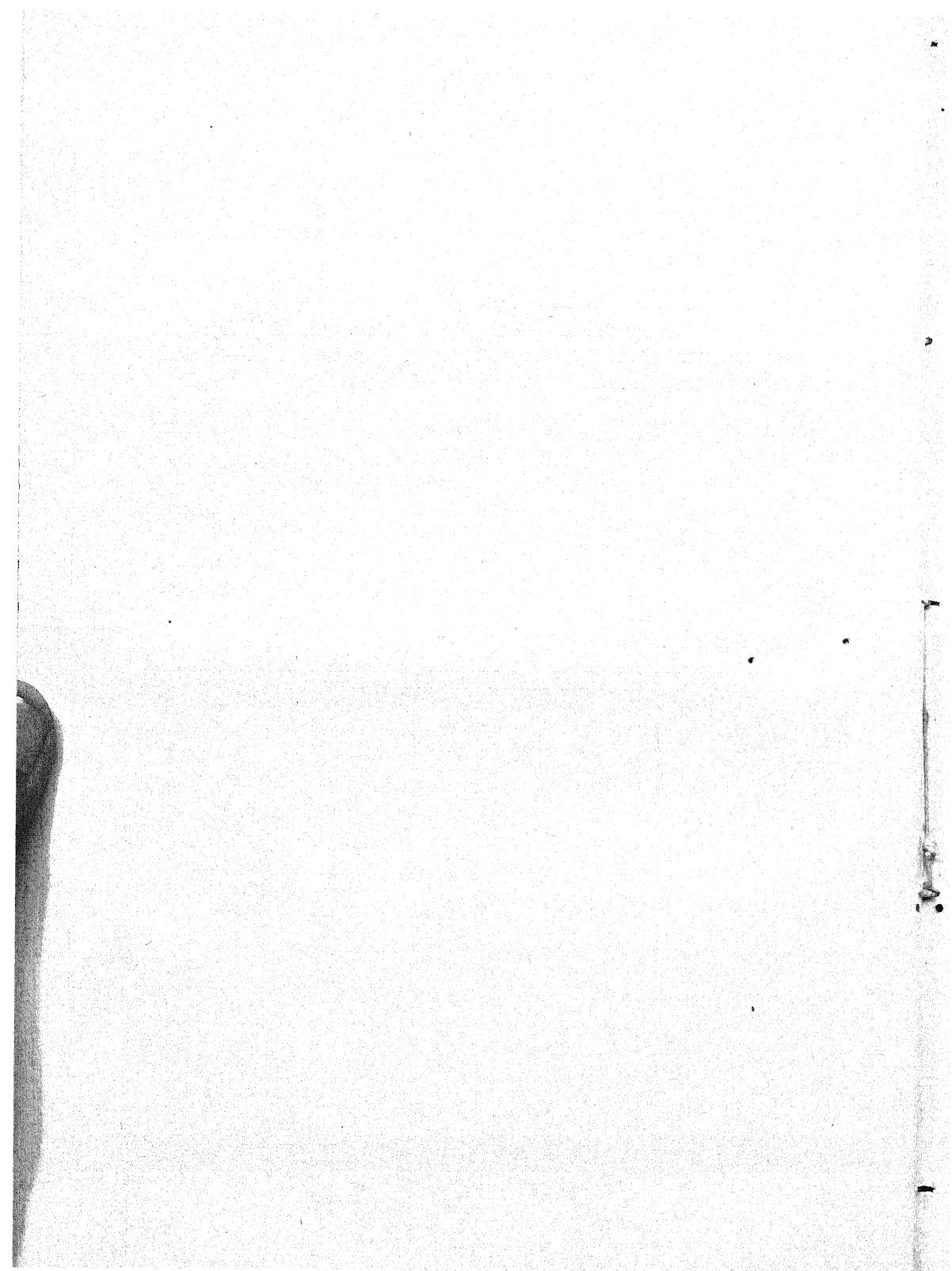
1. **Holboellia latifolia**, Wall. Vern. *Ramkēpa*, RK.—A subdeciduous or evergreen rambling climber, often twining dextrorsely, with stem up to 3 inches diameter and 40 feet high. Twigs smooth, green, striate, sometimes transformed into a tendril at the tip. Bark pale brown, corky and deeply furrowed. Blaze ·3—·4 inch, scarcely fibrous, pale yellow with or without bands of hard orange-coloured gritty tissue, the whole somewhat darkening on exposure. Petiole 1·5—5 inches long, terete, base swollen. Leaflets 3—5, the terminal 3—7 by 1—3 inches, lateral smaller; all oblong or elliptic, acute or acuminate, margin entire and slightly involute, coriaceous, glabrous, dark glossy green above, pale beneath. Petiolule of terminal leaflet ·4—2 inches long, of lateral

shorter. Flowers .5—.7 inch diameter, very fragrant, in few-flowered racemes 1—3 inches long arranged in axillary fascicles, often in the axils of fallen leaves. Female flowers pale chocolate-brown, male pale yellowish-green. Fruit of 1—3 divaricate berries. Berry 2—3 by 1—1.5 inches, smooth, oblong. Seeds numerous, .3—.4 inch long, smooth, shining, black with a viscous fluid beneath the outer coat.

Occurs throughout the central and outer hill ranges between 5,000 and 7,000 feet. Fairly common in *banj* forest. Flowers: April.

2. *Holboellia angustifolia*, Wall. Syn. *Holboellia latifolia*, Wall. var. *angustifolia*. Vern. *Ghomphala*, NG. *Gophal*, NG.—A sub-deciduous or evergreen dextrorse climber 5—10 feet high with stems up to 1 inch diameter. Bark roughish, but not noticeably corky. Petiole 2—6 inches long. Leaflets 5—9, the terminal one 2.5—4.5 by .6—1 inch, lateral smaller; all linear-lanceolate or linear-oblong, acute, often mucronate, margin entire and slightly involute, coriaceous, glabrous. Petiolule of terminal leaflet .2—1.2 inches long, of lateral shorter. Flowers .5—.7 inch diameter, very fragrant, in few-flowered racemes 1—3 inches long arranged in axillary fascicles, often in the axils of fallen leaves. Female flowers yellowish-green, male yellowish-green faintly tinged purple. Fruit of 1—3 divaricate berries. Berry 1—2 by .5 inch, oblong.

Occurs throughout the central and inner ranges between 7,000 and 9,500 feet. Common in shady forest of *Quercus dilatata*. Flowers: April.



VI.—CAPPARIDACEÆ.

Herbs or shrubs, erect or climbing, rarely trees. Leaves alternate or rarely opposite, simple or palmately 3—9-foliolate; leaflets usually entire; with or without stipules. Flowers regular or slightly irregular, bisexual or rarely dioecious. Sepals generally 4, free or connate. Petals usually 4, imbricate, hypogynous or sometimes inserted on the disk. Stamens usually 6, sometimes 4 or numerous. Ovary usually stalked, 1-celled; ovules many. Fruit a pod-like capsule or a berry or rarely a drupe.

Armed shrubs or climbers with simple leaves ... 1. *Capparis*.

An unarmed tree with trifoliolate leaves ... 2. *Crataeva*.

1. CAPPARIS, *Linn.*

Trees or shrubs, erect, straggling or climbing, unarmed or with stipular thorns. Leaves simple or 0. Flowers white or coloured, often showy. Sepals 4, free, in two whorls, all imbricate or the outer valvate. Petals 4, sessile, imbricate. Stamens long, numerous, inserted on the torus at the base of the gynophore. Ovary stalked, 1—4-celled; ovules many, on 2—6 parietal placentae. Fruit fleshy, rarely dehiscent by valves. Seeds numerous, embedded in pulp.

Flowers solitary ... 1. *spinosa*.

Flowers umbellate ... 2. *sepiaria*.

Flowers supra-axillary in a vertical line ... 3. *horrida*.

1. *Capparis spinosa*, *Linn.*—A trailing shrub with stems up to 6 feet long. Young shoots densely white-woolly. Leaves 5—15 inches diameter, orbicular, broadly ovate or obovate, apex retuse or obtusely pointed with a spinous mucro, rather thick, clothed when young with a dense loose white tomentum on both surfaces. Petiole 1—2 inch long. Stipules 1—2 inch long, spinous, stout, yellow, hooked. Flowers 15—2 inches diameter, white fading pinkish-purple, fragrant, axillary, solitary. Peduncle 1—2 inches long, thickened in fruit. Stamens longer than the petals, the tips tinged purple. Berry 1—2 inches long, obovoid, red inside when ripe.

Occurs along the Alakhnanda valley in North Garhwal between Chamoli and Gulabkoti at about 4,000 feet. The trailing stems hang in festoons from crevices in the precipitous rocks. Flowers: May—July. The plant here described is var. *leucophylla*, DC.

2. *Capparis sepiaria*, Linn.—An evergreen climber, often suberect. Twigs pubescent. Leaves 1—2 inches long, variable, ovate-elliptic or elliptic-lanceolate, obtuse, emarginate or acute, glabrous when mature, bright green. Petiole 1—2 inch long, pubescent. Stipules 1 inch long, spinous, hooked, stout, bases pubescent. Flowers 3—5 inch diameter, white, in sessile or shortly peduncled umbels. Pedicels 5—8 inch long, filiform. Stamens 2—3 inch long. Fruit 2—3 inch diameter, globose, smooth, black when ripe.

This species is reported to occur in the Ramnagar Division but there are no specimens from this area at Dehra Dun. It is common in dry places in the adjoining plains districts. Flowers: May—August. Fruit: July—December.

3. *Capparis horrida*, Linn.—A climber with rambling diffuse branches, the stems attaining 20 feet high and 6 inches diameter. Twigs smooth, bright green. Bark fairly smooth, sometimes thinly corky, pale brown. Blaze 1—3 inch, scarcely fibrous, white or pale yellowish. Young parts clothed with caducous rusty-brown pubescence. Leaves 2—4.5 by 1.5—2.5 inches, oblong or ovate, with a short mucro, entire, ultimately shining dark green above, pale beneath. Petiole 2—5 inch long. Stipules spinous, hooked, 1—2 inch long, raised on the old wood on the top of a woody pyramidal pedestal up to 5 inch high. Flowers 2—3 inches across the stamens, sweet-scented, 2—4 in a vertical line above the leaf-axils or sometimes solitary. Sepals 3—4 inch long, ovate, concave, green. Petals 6—9 inch long, ovate, margin undulate, the tumid bases of two of them enclosed within one of the sepals, white tinged with pink, villous within. Stamens 1—1.5 inches long, white fading pink or purple. Peduncles 5—1 inch long, stout. Berry 1—1.5 inches diameter, subglobose, red when ripe, on a very stout stalk.

Occurs in the subhimalayan tract up to 2,500 feet. Fairly common in miscellaneous forest, both dry and moist types. Flowers: March—April. Fruit: August—September.

2. CRATAEVA, Linn.

Small or medium-sized spreading trees. Leaves digitately trifoliate. Flowers large, polygamous. Sepals 4, adnate to the lobed disk. Petals 4, long-clawed, open in bud. Stamens very numerous, inserted at the base of the gynophore. Ovary on a slender stalk, usually 1-celled. Ovules many, on 2 parietal placentae. Berry fleshy with a hard rough rind. Seeds embedded in pulp.

Crataeva religiosa, Forst. Vern. *Barua*.—A small or medium-sized deciduous tree up to 9 feet girth and 50 feet high. Bark dark grey, roughish, with a few vertical fissures. Blaze 5—1 inch, not fibrous, pale yellow narrowly banded or mottled with harder orange tissue. Petiole 1.5—4 inches long. Leaflets 2—6 by 1.5—2.5 inches, ovate

obovate or lanceolate, acuminate, base attenuate, the lateral oblique, entire, glabrous, pale beneath. Petiolules 1—3 inch long. Flowers zygomorphic, 1·5—2·5 inches across, in many-flowered lax corymbs. Sepals ·25—·3 inch long, greenish, inserted with the petals on the margin of the disk. Petals 4 rarely 5, long-clawed, ovate, 1—1·5 inches long, nearly white fading yellow. Stamens pale mauve, slightly exceeding the petals. Disk hemispheric, the margin incurved. Ovary glabrous, green, on a gynophore about 1·5 inches long. Pedicels 1—2 inches long. Berry 1—2 inches diameter, globose, many-seeded; rind woody, smooth. Seeds reniform, imbedded in yellow pulp.

Occurs in the subhimalayan tract up to 2,000 feet. It appears to be rather scarce, and is usually found not far from a watercourse. The conspicuous flowers appear before or with the young leaves. Flowers: April—May. Fruit: July—August.



VII.—BIXACEÆ.

Trees or shrubs. Leaves alternate; stipules small or 0. Flowers regular, 1—2-sexual. Sepals 3—8, usually 4—5, imbricate or rarely connate, usually deciduous. Petals 4—5 or 0, imbricate or contorted in bud, deciduous. Stamens indefinite, usually hypogynous; anthers dehiscing by slits or pores. Ovary 1, usually 1-celled; ovules usually numerous, on 2 or more parietal placentae. Fruit dry or fleshy. Seeds arillate or with a pulpy testa.

I.—Leaves palmately lobed. Flowers large ... 1. *Cochlospermum*.

II. Leaves undivided. Flowers small.

1. Styles 2 or more. Ovary 2- or more-celled 2. *Flacourtia*.

2. Style 1. Ovary 1-celled ... 3. *Xylosma*.

1. COCHLOSPERMUM, *Kunth*.

Trees or shrubs with yellow or red juice. Leaves palmately lobed. Flowers bisexual. Sepals 5, deciduous. Petals 5, large, contorted in bud. Stamens many; anthers opening by a short slit at the top. Ovary nearly 3—5-celled; ovules numerous, on 3—5 parietal placentae. Fruit a 3—5-valved capsule. Seeds numerous, spirally twisted like a snailshell; testa with long woolly hairs.

Cochlospermum Gossypium, *DC.*—A small deciduous tree. Bark pale grey, rough with shallow longitudinal cracks. Blaze 5 inch, whitish with reddish-brown bands, an orange coloured juice exuding from the cambium. Leaves crowded near the ends of the branches, palmately 5-lobed, 3—8 inches diameter, lobes acuminate, entire, glabrous above, more or less white-tomentose beneath. Petiole 4—8 inches long, pubescent when young. Flowers 4—5 inches diameter, yellow, appearing before the leaves, in terminal subcorymbose panicles. Pedicels 2—5 inches long, stout, grey-tomentose. Fruit an obovoid capsule 3—4 inches long, striate, 5-valved. Seeds 2—25 inch long, reniform, densely clothed with deciduous brown wool.

This species has been collected at Laldhang in the Lansdowne Division. In the adjoining Siwalik hills it is found up to 3,000 feet. Flowers: February—April. Fruit: June-July.

2. FLACOURTIA, *Commers.*

Trees or shrubs, often thorny. Leaves toothed or crenate, 3—5-nerved at the base. Flowers small, dioecious, rarely 2-sexual. Sepals

4—5, imbricate. Petals 0. Stamens many; anthers versatile. Styles 2—10, separate, connate or 0; ovules usually in pairs on each placenta. Fruit indehiscent; endocarp hard.

Leaves ovate or suborbicular, never acuminate.

Racemes usually tomentose ... 1. *Ramontchi*.

Leaves oblong or ovate, acuminate. Racemes

glabrous ... 2. *Cataphracta*.

In addition to the above *F. sepiaria*, Roxb., is also according to Duthie found within our area, but I have not described it separately as its occurrence seems open to doubt, and I saw no specimens from our area either at Kew or Dehra Dun. It is a very thorny small bush with straight sharp thorns up to 2 inches long which sometimes bear leaves and flowers. Leaves usually less than 1 inch long, obovate or orbicular with flowers usually solitary or in few-flowered racemes at the ends of the short shoots.

1. *Flacourtia Ramontchi*, L'Herit. Vern. *Bilāngra*, Gen. *Bilāngūr*, Gen. *Kanēl*, E.A.—A subdeciduous shrub or small tree with rounded crown up to 20 feet height and 3 feet girth. Twigs pubescent, sometimes armed with axillary spines. Stems often armed with simple or branched spines up to 6 inches long. Bark pale grey or pinkish-brown, fairly smooth, exfoliating in irregular thin scales. Blaze .25—.35 inch, hard, orange-brown throughout or pale yellow streaked with orange, slightly darkening on exposure. Leaves variable, 1—3 by 1-2 inches, ovate, broadly elliptic, obovate or suborbicular, toothed or crenate, apex acute or rounded, glabrous or pubescent above, more or less pubescent beneath. Petiole .2-.3 inch long. Flowers .25 inch diameter, yellowish-green, dicæious, in short simple or branched usually tomentose racemes. Fruit a berry .3—.5 inch diameter, pink, with 8—16 seeds.

Occurs throughout our area up to 5,500 feet. Common in scrub forest of secondary growth in the hills, also frequent in *chir* forest. The new leaves appear with, or shortly after, the flowers and are often tinged fleshy-pink. Flowers: February-March. Fruit: April-June.

2. *Flacourtia Cataphracta*, Roxb.—A large evergreen shrub or small tree up to 30 feet high. Stems up to 2.5 feet girth, often armed low down with stout compound spines up to 5 inches long. Bark fairly smooth, pale brown. Blaze .2 inch, pale yellow freckled with yellowish-brown, darkening on exposure. Leaves 2—4 by .9-1.5 inches, oblong or ovate, acuminate, crenate-serrate, glabrous, dark green above and shining on both surfaces. Petiole .1-.2 inch long, minutely pubescent. Flowers .1—.15 inch diameter, in glabrous few-flowered racemes .3—1 inch long. Fruit .7—.9 inch long, obovoid, green turning brownish-purple when ripe.

This species is reported to occur in the East Almora and Haldwani Divisions, but there are no specimens from our area at Dehra Dun, and I did not see any at Kew. It is however found in the *sal* forests of the Dun up to 2,000 feet. Adventitious shoots often bear simple spines. Flowers: July-August. Fruit: November-December.

3. XYLOSMA, *Forster*.

Characters of *Flacourtia*, but with rarely more than 2 placentæ in each 1-celled ovary, and with the style usually entire, short, and ending in a few sessile stigmas. Berry globose, 2—10-seeded.

Xylosma longifolium, *Clos*. Vern. *Sallu*, Gen. *Kand-gair*, G. *Kanai*, R.—A small or medium-sized evergreen tree attaining 7 feet girth and 60 feet high. Bark fairly smooth, pale brown, with scattered small raised lenticels. Blaze 35—75 inch, very hard, not fibrous, pale yellow densely mottled with orange, sometimes pinkish towards the exterior. Branches and root-suckers often armed with straight stout spines 5—2 inches long. Leaves 3—6 by 1-2 inches, lanceolate or oblong-lanceolate, glabrous, coriaceous, dark shining green with pale primary and secondary nerves above, smooth with inconspicuous nerves beneath, acuminate, shallowly and bluntly crenate-serrate. Petiole 2—4 inch long. Flowers small, greenish-yellow, diœcious, in dense fascicled axillary panicles up to 7 inch long. Stamens conspicuous in the males, 15—25 inch long. Fruit a berry 3-4 inch diameter, depressed-globose, first greenish-yellow finally red when ripe containing 2—10 seeds.

Occurs throughout our area up to 5,000 feet. Common along ravines in the hills, and in swampy localities in the Bhabar. In wet localities it frequently sends up strong root suckers. Flowers : October—December. Fruit : March—May.

VIII.—PITTOSPORACEÆ.

Trees, erect or climbing shrubs. Leaves alternate, rarely opposite or verticillate, entire or rarely toothed. Flowers hermaphrodite. Sepals 5, free or connate, imbricate. Petals 5, hypogynous, free or connate, imbricate. Stamens 5, free; anthers versatile. Ovary 1-celled, or 2—5-celled by the intrusion of as many parietal placentæ; style simple; stigma terminal, 2—5-lobed; ovules many, parietal or axile. Fruit capsular or indehiscent.

PITTOSPORUM, *Banks*.

Trees or erect shrubs. Sepals free or connate below. Petals erect, recurved at the top, claws connivent or connate. Stamens 5, erect; anthers 2-celled, bursting inwards by slits. Ovary sessile or shortly stalked, incompletely 2—3-celled; ovules 2 or more on each placenta. Capsule 1-celled, woody, 2- or 3-valved; placentæ in the middle of the valves.

Young shoots, leaves beneath and capsules tomentose 1. *eriocarpum*.

Young shoots, leaves and capsules glabrous ... 2. *floribundum*.

1. *Pittosporum eriocarpum*, *Royle*. Vern. *Radūthia*, RK.—An evergreen shrub or small tree attaining 4 feet girth and 20 feet high. Twigs stout, more or less densely clothed with pale brown tomentum, at least when young. Bark smooth, pale brown, with small raised circular or horizontally-elongated lenticels. Blaze 2—4 inch, soft with rather short fibre, white and sometimes yellowish-brown towards the exterior. Leaves 4—7·5 by 1·5—3 inches, obovate or oblong-lanceolate, acute or shortly acuminate, entire, rather coriaceous, brown-tomentose on both surfaces when young, dark glossy green and glabrous (or nearly so) above when mature, more or less pale brown-tomentose beneath, main lateral nerves rather prominent beneath, about 8—15 pairs. Petiole 4-1 inch long. Flowers 3 inch long, pale yellow, in many-flowered, compound, tomentose, often sub-umbellate corymbs. Style persistent. Capsule 5·6 inch diameter, globose, densely tomentose or ultimately glabrescent, woody, 2-valved, containing numerous orange-red seeds surrounded by a viscid juice.

Occurs throughout the hills between 3,000 and 6,500 feet. Chiefly found along the outer ranges in *banj* or miscellaneous forests, but is rather scarce. Flowers: March-April. Fruit: September—November.

2. *Pittosporum floribundum*, W. & A.—A small evergreen tree attaining 6 feet girth and 40 feet high. Twigs slender, glabrous, lenticellate. Bark slightly rough, pale ashy or light brown with numerous lenticels. Blaze .35—.5 inch, pale yellow streaked or mottled with pale yellowish-brown, the whole slightly darkening on exposure. Leaves 3.5-6.5 by 1-2 inches, lanceolate or oblong-lanceolate, acute or acuminate, thinly coriaceous, entire, margin undulate, glabrous, shining above, pale beneath with indistinct lateral nerves. Petiole .4—.8 inch long. Flowers .2 inch long, yellow, numerous, in much-branched terminal compound corymbs. Style persistent. Capsule .2-.3 inch diameter, globose, glabrous, greenish-yellow (the valves turning black as soon as the fruit has dehisced), woody, 2-valved, containing 3-4 orange-red seeds surrounded by a viscid juice.

Occurs throughout our area up to 4,500 feet. Scarce in the inner hills, but fairly common along ravines in the Bhabar forests. Flowers: June-July. Fruit: December—February.

IX.—TAMARISCACEÆ.

Mostly bushes or small trees. Leaves minute, scale-like, rarely sheathing, sometimes fleshy, exstipulate. Flowers white or pink, small, regular, in spikes or crowded racemes. Sepals and petals 5 each or rarely 4, sometimes a little connate below. Stamens 4—10 or many, free or connate below; anthers versatile. Disk 10-glandular. Ovary free, 1-celled or imperfectly 2—5-celled; styles 2—5, free or connate; ovules 2-many on each of the 2—5 basal placentæ. Capsule 3-valved. Seeds plumed with a crest of long hairs or winged.

Stamens 5, free. Styles 3 or 4 ... 1. *Tamarix*.

Stamens 10, connate. Stigmas sessile ... 2. *Myricaria*.

1. TAMARIX, Linn. (*The Tamarisks*.)

Shrubs or small trees. Leaves minute, scale-like, amplexicaul or sheathing. Flowers white or pink, in spikes or dense racemes. Sepals and petals free. Stamens 4—10; anthers spiculate. Ovary narrowed upwards; styles 3-4, short, dilated into stigmas above. Seeds with a sessile plume.

***Tamarix dioica*, Roxb.** Vern. *Jhau*, Gen.—A shrub with stems up to 25 feet high and 8 inches diameter. Bark dark brown, rather rough with shallow fissures. Twigs marked by conspicuous evenly-spaced annular rings representing the attachment of fallen leaves. Leaves scale-like, sheathing, sheath tubular, apex acuminate and closely adpressed. Flowers dicecious, small, pink, in compact spikes 1-2 inches long, often forming loose drooping panicles at the ends of the branches. Bracts nearly as long as the flower, persistent, lanceolate, acuminate, with membranous white margins.

This species is believed to occur along the banks of streams within the area of this flora, but there are no specimens at Dehra Dun, and I saw none at Kew. It is common in the plains districts to the south. Flowers: July-August.

2. MYRICARIA, Desv.

Fastigiate shrubs. Leaves small, flat, sessile, often crowded. Flowers white or pink, hermaphrodite, in lateral or terminal spike-like racemes. Sepals 5. Petals 5, free. Stamens 10, alternately long and

short, monadelphous. Disk almost obsolete. Stigmas 3, sessile; placentæ basal; ovules numerous. Seeds usually with a stalked plume.

Stems 1—3 feet high. Leaves .1—·3 inch long ... 1. *germanica*.

Stems up to 15 feet high. Leaves .3—·8 inch long 2. *elegans*.

1. *Myricaria germanica*, *Desv.*—A deciduous shrub with erect or decumbent stems 1—3 feet high and up to .5 inch diameter. Twigs smooth, glabrous, reddish- or purplish-brown, bearing fascicled deciduous side-shoots usually .5—4 inches long. Leaves .1—·3 inch long, linear-lanceolate, entire, glaucous-blue, glabrous. Flowers pink, in lateral and terminal spike-like racemes 2—6 inches long, sometimes forming a terminal panicle up to 18 inches long. Pedicels up to .1 inch long. Bracts .15—·3 inch long with broad membranous margins. Petals white. Calyx and flowering rachis purplish-red. Capsule .3—·5 inch long.

Occurs on the inner dry ranges bordering Tibet between 11,000 and 14,000 feet. It sometimes forms gregarious patches on bare boulder formations bordering streams. Flowers: June-July. Fruit: July-August.

2. *Myricaria elegans*, *Royle*. Vern. *Wombu*, NG.—An erect deciduous shrub 10—15 feet high. Twigs smooth, glabrous, reddish-brown. Bark grey or dark brown, rough, with numerous small fissures. Branches bearing fascicled deciduous side-shoots 2—6 inches long. Leaves .3—·8 by .1—·15 inch, oblong-lanceolate, narrowed at both ends, entire, glaucous-blue, glabrous. Flowers pink or white, in lateral and terminal spike-like racemes 2—5 inches long, sometimes forming a terminal panicle up to 8 inches long. Pedicels up to .1 inch long. Bracts .1—·2 inch long, with narrow membranous margins. Petals white. Calyx and pedicels green or pink. Capsule .25—·35 inch long.

Occurs on the inner dry ranges bordering Tibet between 8,000 and 14,000 feet. It is usually found growing along the banks of streams on loose stony or boulder formations. Flowers: June-July.

X.—HYPERICACEÆ.

Shrubs or herbs, rarely trees. Leaves opposite or rarely alternate, often marked with transparent or black dots, exstipulate. Flowers hermaphrodite, regular, solitary or cymose, terminal or rarely axillary, yellow red or white. Sepals and petals usually 5 each, free, imbricate, the petals contorted in bud. Stamens indefinite, free or variously combined into 3 or 5 bunches or rarely all connate. Ovary 3—5-carpelled, 1- or 3—5-celled; styles free or connate; ovules few or many on axile or parietal placentæ, or rarely solitary and basal. Fruit capsular or baccate.

HYPERICUM, *Linn.*

Herbs, shrubs or small trees. Leaves usually sessile. Flowers cymose, yellow, usually terminal. Sepals 5. Petals 5, usually somewhat oblique at the top. Ovary 1-celled with 3 or 5 parietal placentæ or 3—5-celled with axile placentæ; styles free or connate; ovules usually many. Capsule septicidal or, when 1-celled, splitting through the placentæ.

I.—Leaf-base decurrent forming a raised line on either side of the shoot. Sepals less than .3 inch long ... 1. *patulum*.

II.—Leaf-base not decurrent. Sepals .3 inch long or more.

A. Stamens more than half the length of the petals.

1. Secondary nerves plainly visible on the lower leaf-surface.

(a) Petals obovate ... 2. *cernuum*.

(b) Petals narrowly oblong ... 3. *lysimachioides*.

2. Secondary nerves scarcely visible on the lower leaf-surface ... 4. *cordifolium*.

B. Stamens less than half the length of the petals.

Secondary nerves plainly visible on the lower leaf surface ... 5. *Hookerianum*.

1. *Hypericum patulum*, *Thunb.*—An erect evergreen shrub usually 2—4 feet high but attaining 6 feet with stem up to 2 inches diameter. Twigs slender, reddish, appearing somewhat two-sided owing to the decurrent leaf-bases. Bark reddish-brown, fairly smooth. Leaves .6—1.75 by .3—.75 inch, elliptic-lanceolate, entire, acute or with a blunt point, base rounded or cuneate, lateral nerves easily visible on the undersurface, dull dark green above, pale and somewhat glaucous beneath, distichous, sessile, the leaf-base decurrent and forming a raised line on either side of the shoot. Flowers .7—1.2 inches diameter, in

few-flowered terminal cymes. Sepals .15—.25 inch long, elliptic or suborbicular, obtuse. Petals suborbicular. Styles about the same length as the ovary. Capsules .2—.4 inch long.

Occurs throughout the central and outer hill ranges between 3,000 and 7,000 feet. Fairly common on steep banks and shady places in *banj* forest. Flowers: July-October.

2. *Hypericum cernuum*, Roxb. Vern. *Chaya*, NG. *Aluba*, RK. *Piunli*, RK.—An evergreen shrub usually 2-3 feet high, but stem attaining 6 feet high and 1.5 inches diameter. Twigs stout, terete. Bark slightly rough, reddish-brown. Leaves 1.5—4 by .5—1.75 inches, oblong-oblong-lanceolate or oblong-ovate, entire, decussate, glabrous, glaucous on both surfaces, lateral nerves easily visible on the under-surface, dotted with small translucent glands, sessile, the leaf-base not decurrent. Flowers 2 inches diameter, in terminal 3—7-flowered cymes. Sepals .3 inch long, ovate. Petals obovate. Stamens 5-adelphous at the base. Styles twice as long as the ovary. Capsule .3—.6 inch long.

Occurs throughout the hills between 4,000 and 8,000 feet. Common in *banj* and open miscellaneous forests. Flowers: March-May. Fruit: July.

3. *Hypericum lysimachioides*, Wall.—An erect shrub 1—4 feet high with stems up to .5 inch diameter. Twigs slender, often drooping, terete. Leaves .8—2 by .3—1.2 inches, usually lanceolate, sometimes ovate, entire, tip acute or rounded, base rounded or cuneate, distichous, glabrous, pale glaucous beneath, the lateral nerves easily visible on the undersurface, pellucid-punctate. Petiole up to .1 inch long, not decurrent. Flowers .8—1.5 inches diameter, yellow, in 2-3-chotomous, lax, leafy and terminal cymes. Sepals .3—.5 inch long, narrow-lanceolate, acute. Petals narrowly oblong. Styles twice as long as the ovary. Capsule .2-.3 inch long.

Occurs throughout the hills between 5,000 and 8,000 feet. Fairly common on steep slopes and rocky places in undergrowth. Flowers: July-August.

4. *Hypericum cordifolium*, Choisy.—A shrub 1-2 feet high. Leaves 1-2 by .4—.7 inch, oblong-lanceolate, entire, acute, base subcordate or cordate, glabrous, glaucous beneath, lateral nerves scarcely visible on the undersurface, sessile, the leaf-base not decurrent, decussate. Flowers 1.5—2 inches diameter, in few- or many-flowered terminal leafy-bracteate cymes. Sepals .4-.5 inch long, lanceolate or ovate. Petals obovate. Styles 1-1.5 times as long as the ovary.

Has been collected between Giri and Munshiari and again at Wokuri on the Kharbajas-Sama road in Upper Almora between 4,000 and 6,000 feet. Flowers: August-September.

5. *Hypericum Hookerianum*, W. & A.—An erect deciduous shrub 6 inches to 3 feet high with stems up to .3 inch diameter. Leaves 1-2.5 by .4-1 inch, ovate or lanceolate, entire, tip usually acute, base rounded,

pale glaucous beneath and often tinged purple on young leaves, the lateral nerves easily visible on the undersurface. Petiole up to .1 inch long, not decurrent. Flowers 1.5-2 inches diameter, in 1—7-flowered terminal bracteate cymes, often solitary. Sepals ovate or lanceolate, acute, .3—.6 inch long. Petals suborbicular. Styles half to two-thirds the length of the ovary. Capsule .4—.6 inch long.

Occurs along the main Himalayan range between 7,000 and 11,000 feet. It is rather scarce and is found on steep grassy slopes and in open *karshu* forest. Flowers: July-August. The plant here described is var. *Leschenaultii*, Choisy.

XI.—TERNSTRÆMIACEÆ.

Trees or shrubs, sometimes climbing. Leaves usually coriaceous and simple, alternate, penninerved, serrate or entire, rarely stipulate. Flowers usually showy, 2- rarely 1-sexual, regular. Sepals usually 5, free or shortly connate, imbricate or very rarely valvate. Petals usually 5, usually connate and much imbricate. Stamens usually indefinite and adnate to the base of the petals, sometimes monadelphous. Ovary superior or rarely half-inferior, 2—5- many-celled; styles as many as the cells, free or connate. Ovules 1, 2 or many in each cell. Fruit a berry or capsule.

I.—Trees or shrubs.

A. Leaves 7—14 inches long. Flowers in pedunculate axillary panicles ... 1. *Saurauja*.

B. Leaves under 6 inches long. Flowers solitary or in axillary fascicles.

1. Leaves crenate-serrate ... 2. *Eurya*.

2. Leaves entire ... 3. *Cleyera*.

II.—A climber ... 4. *Actinidia*.

1. SAURAUJA, *Willd.*

Trees or shrubs. Inflorescence lateral, often from the axils of fallen leaves, cymose, subpaniculate, rarely few-flowered. Flowers usually hermaphrodite. Sepals 5, strongly imbricate. Petals 5, usually connate at the base. Stamens numerous. Ovary 3—5-celled; styles as many, free or more or less united; ovules many. Fruit a berry, rarely dry and subdehiscent.

***Saurauja nepaulensis*, DC.** Vern. *Gōgna*, *Gōgin* or *Gūgna*, Gen.—

A small evergreen tree with stem up to 3 feet girth and 30 feet high. Twigs stout, more or less densely clothed with rusty-brown hairs. Bark dark brown, rough, sometimes deeply cracked, corky, exfoliating in small irregular scales. Blaze 4-5 inch, soft, cheesy, pinkish or nearly white with a sticky juice. Leaves crowded towards the ends of the branches, 7—14 by 2.5—4 inches, oblong or oblanceolate, acute or acuminate, sharply serrate, rusty-tomentose beneath especially when young; lateral nerves about 25—30 pairs, close and prominent. Petiole .5—1.5 inches long, rusty-tomentose. Flowers .5 inch diameter, pink, in lax, drooping, pedunculate, axillary panicles 4—9 inches long. Peduncle and pedicels rusty-tomentose, the former 2—5 inches long.

Berry .4 inch diameter, depressed-globose, 4-5-lobed, green, fleshy with a mealy sweet pulp.

Occurs throughout the hills between 3,000 and 6,000 feet. Rather scarce. Usually found in moist valleys and on northern aspects, sometimes in *chir* forest. Flowers: February—June. Fruit: May—July.

2. EURYA, *Thunb.*

Shrubs or small trees. Leaves glabrous or slightly pubescent, usually crenate-serrate. Flowers dioecious, in small axillary clusters or, rarely, solitary; pedicels short. Sepals and petals 5 each, imbricate, expanding but little. Stamens in male flower 5—15, usually about 12. Ovary 2—5-celled, with as many free or united styles; ovules many. Fruit a berry.

Eurya acuminata, DC. Vern. *Chōpri* or *China*, NG. *Padlār* or *Gunēsh*, RK.—An evergreen shrub or small tree up to 25 feet high and 4 feet girth. Young shoots hairy. Bark reddish-brown, slightly rough, lenticellate. Blaze .25 inch, reddish-brown usually streaked with white. Leaves 2—4 by .5—8 inch, narrowly oblong-lanceolate, acuminate, closely crenate-serrate with gland-tipped teeth, coriaceous, glabrous and glossy dark green with depressed primary and secondary nerves above, usually hairy on the midrib beneath. Petiole up to .1 inch long. Flowers .2 inch diameter, white, orduriferous, solitary or fascicled 2—5 together in the leaf-axils often of fallen leaves. Peduncles slender, up to .1 inch long. Berry .2—25 inch long, ovoid, glabrous, black, seated on the persistent somewhat succulent calyx and capped by the persistent style. Seeds small, embedded in a juicy blue-black tissue.

Occurs throughout the hills between 4,000 and 8,500 feet. Fairly common in oak forest especially on cool north aspects where the forest is dense and the soil moist. Flowers: September—December. Fruit: July—September.

3. CLEYERA, DC.

Trees or shrubs. Peduncles lateral, often fascicled; bracts minute or 0. Sepals 5. Petals 5, more or less connate at the base. Stamens many; anthers pilose. Ovary 2-3-celled; style often elongate with a shortly 2-3-fid apex, or shorter and more deeply divided; ovules many.

Cleyera ochracea, DC.—A shrub or small tree. Twigs glabrous. Leaves 2.5—5 by 1.25—2 inches, oblong elliptic or oblong-obovate, abruptly and shortly blunt-acuminate, base obtuse or acute, entire, coriaceous, glabrous, with about 14—18 pairs of fine rather indistinct lateral nerves anastomosing within the leaf-margin. Petiole .2—5 inch long, stout. Flowers .5—7 inch diameter, white, solitary or in fascicles of 2-3 together, axillary, sometimes in the axils of fallen leaves.

Peduncle .5—.8 inch long, thickened upwards, glabrous. Petals oblong, three times the length of the persistent sepals. Style persistent. Fruit a berry.

Occurs in the East Almora Division between 4,000 and 6,000 feet. Usually in damp places and nals. Mr. W. J. Lambert reports it to be fairly common about Chowkooori and Berenag. Flowers : June-July.

4. ACTINIDIA, *Lindl.*

Shrubs, usually climbing. Leaves entire or serrate. Flowers polygamous or dioecious, in axillary cymes, rarely solitary. Sepals 5, slightly imbricate, subconnate at the base. Petals 5, somewhat contorted-imbricate. Stamens numerous. Ovary many-celled; styles as many as the cells, divergent and elongated after flowering. Fruit a berry.

***Actinidia callosa*, Lindl.**—A subdeciduous climber with stem up to 50 feet high and 4 inches diameter. Bark rough, pinkish-brown. Blaze .3-.4 inch, pinkish mottled with orange, the whole turning orange-brown on exposure. Twigs smooth, glabrous, with conspicuous elongated pale lenticels. Leaves 3—5 by 1.5—2.5 inches, elliptic or oblong, acuminate, finely cuspidate-serrate, base rounded or slightly cordate, glabrous, with 6—8 pairs of lateral nerves. Petiole .7—2.5 inches long, pinkish. Flowers .5—1 inch diameter, white, in pedunculate, axillary, 1—7-flowered cymes. Peduncle .2—1.2 inches long. Pedicels .4—1 inch long. Berry .8 inch long, fleshy, ovoid.

Occurs in the hills between 2,000 and 6,000 feet. Very scarce. Flowers : May-June. Fruit : September.



XII.—DIPTEROCARPACEÆ.

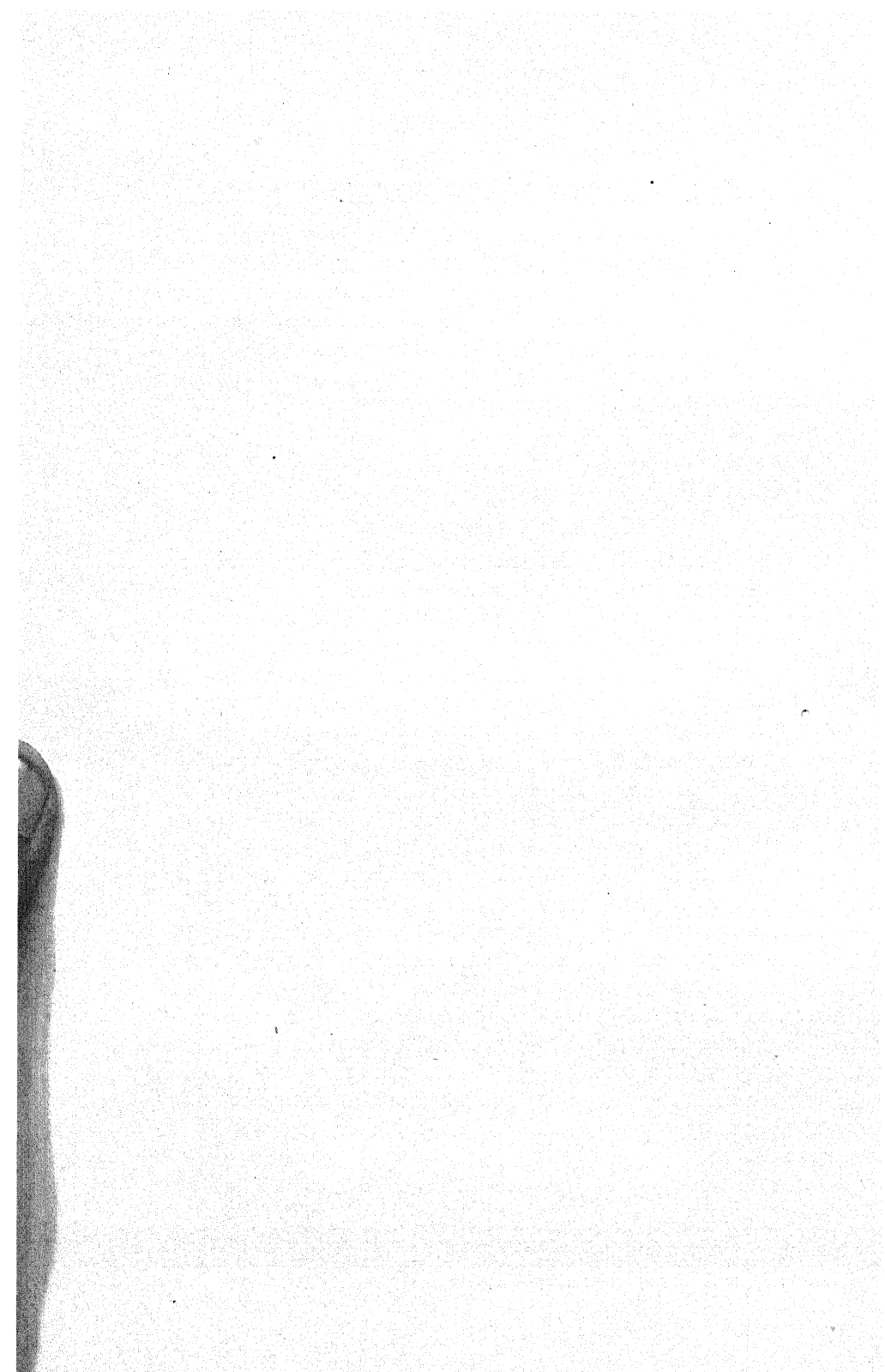
Resinous trees. Leaves alternate, entire or rarely crenate, pinnerved, usually with small stipules. Flowers regular, hermaphrodite, usually sweet-scented, in racemes or panicles. Calyx free and campanulate or short and adnate to the ovary. Petals 5, contorted. Stamens numerous, 15, 10 or 5, variously connate or free; filaments usually short and often dilated below; connective often produced into an appendage above. Ovary usually slightly adherent to the calyx, usually 3-, rarely 1-celled; style usually quite entire; ovules 2 in each cell. Fruit an indehiscent nut or a 3-valved capsule usually enclosed in the accrescent calyx and often winged by the elongation of 2 or more of the sepals.

SHOREA, *Roxb.*

Trees, rarely shrubs. Stipules often large, coriaceous or persistent. Panicles axillary or terminal. Sepals imbricate, united at the base into a very short tube. Anthers usually ovate or oblong with a subulate extension of the connective. Ovary of 3 2-ovuled cells. Fruit with a leathery rarely woody pericarp, 1-celled, 1-seeded, closely surrounded by the bases of the persistent, usually accrescent, sepals, the 3 outer of which are usually developed into linear-oblong wings.

Shorea robusta, *Gaertn.* Vern. *Sal*, Gen. *Kandār*, SG.—A large subdeciduous tree, the stem attaining 12 feet girth and 130 feet high. Bark of young trees smooth with a few long and deep vertical cracks, of old trees rough with numerous long deep and wide vertical fissures, dark reddish-brown or grey. Blaze .7—1.2 inches, dark red to pinkish-brown, paler towards the interior, very fibrous and tough, juice turning purple on the blade of a knife. Leaves 4—8 by 2—5 inches, ovate-oblong, very shortly acuminate, entire, base cordate or rounded, thinly coriaceous, glabrous and shining when mature, with 12—15 pairs of lateral nerves. Petiole .5—.8 inch long. Flowers .4—.5 inch long, yellowish, in terminal and axillary, lax, spreading panicles 3—9 inches long, branches grey-tomentose. Fruit .5—.7 inch long, ovoid, acute, indehiscent, pubescent, embraced by the bases of the accrescent wing-like sepals, which are somewhat unequally 2-3 inches long and linear-oblong or spatulate.

Occurs in the subhimalayan tract and outer hill ranges where it grows gregariously over immense areas and is the principal tree of forest importance. It rarely reaches an elevation of 4,500 feet and is then frequently mixed with *chir*. At Hathiguliar in the Ramnagar Division I have measured an apparently sound tree 18 feet girth and 130 feet high. At its uppermost limit it is reduced to a small tree which is mature at 3 feet girth. Flowers: March—May. Fruit: May—July.



XIII.—MALVACEÆ.

Herbs shrubs or rarely trees; stellate hairs often present. Leaves alternate, usually palmately nerved, simple lobed or digitate; stipules free, caducous or 0. Flowers regular, usually bisexual, often large and showy and frequently with an involucre of bracts below the calyx. Sepals usually 5, valvate, more or less united. Petals usually 5, more or less adnate to the base of the staminal tube. Stamens many, rarely few, monadelphous or rarely 5-adelphous; anthers ultimately 1-celled. Ovary 2-many-celled, entire or lobed, of 2-many carpels; ovaries 1 or more in each cell; styles distinct or connate. Fruit of dry indehiscent cocci, or capsular and loculicidal, or rarely large woody and indehiscent.

I.—Shrubs. Staminal tube entire or slightly divided at the apex.

A. Fruit composed of several carpels separating from the axis. Flowers not exceeding 1.5 inches diameter.

1. Flowers yellow. Carpels not spinescent.

a. Carpels 1-seeded. Flowers not exceeding .7 inch diameter.

i. Bracteoles 0 1. *Sida*.

ii. Bracteoles 3 2. *Malvastrum*.

b. Carpels 2- or more-seeded. Flowers exceeding .8 inch diameter 3. *Abutilon*.

2. Flowers pink. Carpels densely spinescent 4. *Urena*.

B. Fruit capsular. Flowers 3—5 inches diameter 5. *Hibiscus*.

II.—Trees. Staminal tube dividing into 5 bundles of stamens.

1. Leaves simple 6. *Kydia*.

2. Leaves digitate 7. *Bombax*.

1. *SIDA*, Linn.

Herbs or undershrubs, pubescent with simple or stellate hairs. Leaves simple, toothed; stipules linear. Peduncles axillary, solitary or clustered, disarticulating in fruit at a joint below the calyx; bracteoles 0. Sepals 5, connate below. Corolla small, yellow or white. Staminal tube divided into numerous filaments at the top. Ovary 5—12-celled; ovules 1 in each cell; styles as many as the carpels; stigmas

terminal. Fruit depressed-globose, enclosed in the calyx; carpels separating from each other and from the axis.

I.—Petioles of the lower leaves exceeding .5 inch long.

- | | | | | |
|-------------------|---------------------------------------|-----|-----|----------------------------|
| 1. Carpels middle | 5. Peduncles jointed about the middle | ... | ... | 1. <i>veronicaefolia</i> . |
| 2. Carpels top | 7—10. Peduncles jointed near the top | ... | ... | 2. <i>cordifolia</i> . |

II.—Petioles less than .5 inch long.

- | | |
|--|-------------------------|
| 1. Leaves narrow-lanceolate, glabrous or nearly so | 3. <i>acuta</i> . |
| 2. Leaves rhomboid or suborbicular, hoary beneath | 4. <i>rhombifolia</i> . |

1. ***Sida veronicaefolia*, Lamk.** Syn. *S. humilis*, Willd. Vern. *Bhiunli*, H.—A small herb or shrub with erect or procumbent stems, usually 2-3 feet high when erect but occasionally up to 5 feet high and .3 inch diameter. Branches hairy with stellate as well as long spreading hairs. Leaves .5—2.5 inches long, broadly ovate or suborbicular, cordate, acute or acuminate, crenate-serrate, membranous, sparsely hairy and somewhat scabrous, base 5—7-nerved. Petiole .4—1.5 inches long, shorter than the blade. Flowers .3—.5 inch diameter, yellow, axillary, solitary or in pairs, often forming a large raceme-like or panicle-like inflorescence due to the reduction of the leaves. Peduncles slender .5—1.5 inches long, jointed at or just above the middle. Carpels 5, smooth, blunt or with a 2-lipped beak.

Occurs throughout the area up to 4,000 feet. Common on waste land, also in dry miscellaneous forest and often associated with *khair*. Flowers: September—February. Fruit: October—March.

2. ***Sida cordifolia*, Linn.** Vern. *Balu*, RK.—An erect deciduous shrub 2—8 feet high with stems up to .75 inch diameter, sparingly branched. Bark fairly smooth, yellowish or greenish-brown, the inner bast very tough and strong. Branches with long spreading hairs and short stellate pubescence. Leaves variable in size, 1—3 by .8—2.5 inches, ovate or ovate-oblong, obtuse, cordate, crenate, softly downy with stellate pubescence on both sides, base 5—7-nerved. Petiole .5—2 inches long. Flowers .4-.5 inch diameter, pale yellow, solitary or few together usually forming large panicle-like terminal inflorescences due to the reduction of the leaves. Peduncles up to 1 inch long, jointed near the top. Carpels 7—10. Awns 2, long, covered with stiff reflexed hairs.

Occurs throughout our area up to 5,000 feet. Common in the subhimalayan tract especially in dry miscellaneous forest, sometimes associated with *shisham*. It often forms small gregarious patches. Flowers: August—October. Fruit: October—November.

3. ***Sida acuta*, Burm.** Syn. *S. carpinifolia*, Linn.—A small erect shrub with stems up to 4 feet high and .5 inch diameter. Bark smooth, greenish with numerous inconspicuous small lenticels. Twigs

sparsely stellate-hairy. Leaves 1·5—3·5 by ·5—1·5 inches, lanceolate, gradually tapering to an acute point, base rounded, serrate or crenate-serrate, sparsely stellate-hairy beneath when quite young, glabrous when mature, pale dull green above, base 3-nerved usually with two subsidiary weak ones below; lateral nerves including the basal 7—9 pairs, prominent beneath and impressed above. Petiole 0—·25 inch long. Stipules ·3—·5 inch long, linear, hairy. Flowers about ·4 inch diameter, yellow, solitary or in pairs. Peduncles up to ·5 inch long, jointed about the middle. Carpels 5—10, reticulate; awns 2, about one-third the length of the carpel.

Has been collected at the base of the hills in the Haldwani Division and will probably be found along the whole subhimalayan tract up to 2,000 feet. It is usually found growing on waste or open ground. The bark yields a good fibre. Flowers: August—December.

4. *Sida rhombifolia*, Linn. Vern. *Bhiunli*, H.—A small erect deciduous shrub 1—3 feet high with stems up to ·3 inch diameter. Branches stellately hairy. Leaves variable in shape and size; lower leaves usually 1—2·5 inches long, rhomboid or sub-orbicular, base cuneate; upper leaves narrowly rhomboid; all with cuneate base, margin crenate-serrate but often entire towards the base, more or less densely stellate-pubescent beneath, base 3-nerved. Petiole up to ·3 inch long. Flowers ·3·4 inch diameter, yellow, axillary, solitary or in pairs, often forming a panicle-like inflorescence due to the reduction of the leaves. Peduncles ·1—·8 inch long, jointed in the middle. Carpels 8—10; awns 2.

Occurs throughout the area up to 3,000 feet and probably higher, but the plant found at higher elevations may be the variety mentioned below. Common on waste land and in openings in *sal* forest. Flowers: August—September. Fruit: October—November.

Var. *obovata* (Sp. Wall.)—This variety has more often a procumbent stem. Leaves seldom exceeding 1 inch long, broadly rhomboid, obovate or rounded, crenate-serrate, base cuneate, densely stellate-hairy beneath, base 3—5-nerved. Peduncle up to ·3 inch long, jointed about the middle. Awns sometimes obsolete. It has been collected in the Haldwani Division and is probably common.

2. MALVASTRUM, A. Gray.

Herbs or shrubs. Leaves entire or lobed. Flowers axillary or in a leafy terminal spike; bracteoles 3, narrow. Calyx cup-shaped, 5-partite. Petals longer than the sepals. Staminal tube bearing anthers on the outside up to the top. Ovary 5- or more-celled; styles as many as the cells; stigmas capitate. Cocci free at maturity, indehiscent, 1-seeded.

***Malvastrum tricuspidatum*, A. Gray.** Syn. *M. coromandelianum*, Garcke.—An erect shrub or herb 6 inches to 2 feet high with stem up to

·3 inch diameter. Twigs stellate-hairy, the branches of the hair adpressed. Leaves ·8—2 inches long, ovate or ovate-lanceolate, serrate, 5-nerved at the base, the main lateral nerves deeply impressed above and prominent beneath, sparsely hairy on both sides. Petiole up to ·7 inch long, densely stellate-hairy. Flowers solitary, ·5—·7 inch diameter, yellow. Carpels 8—12, reniform, hispid on the top and with 3 projecting points.

Occurs in the subhimalayan tract, chiefly in open places near cultivation. The plant is a weed which has been introduced from America, but which has become completely naturalised. Flowers during most months of the year.

3. ABUTILON, Gaertn.

Tomentose shrubs or herbs. Leaves usually cordate and long-petioled, dentate, rarely slightly lobed. Flowers usually solitary, on axillary peduncles which are jointed near the top, yellow or orange; bracteoles 0. Sepals, petals and stamens as in *Sida*. Carpels 5-many; styles as many as the carpels; stigmas small, capitate. Ripe carpels ultimately separating from the short central axis, dehiscent, 1—5-seeded, usually acute or mucronate. Seeds reniform.

Carpels 15—20. Lower leaves 1·5—3·5 inches long 1. *indicum*.

Carpels 5—7. Lower leaves 3—8 inches long "... 2. *polyandrum*.

1. **Abutilon indicum**, Sweet.—An erect shrub 4—10 feet high with stems up to 1 inch diameter. Bark smooth, pale greenish-brown. Branches clothed with short close pubescence. Leaves 1·5—3·5 by 1·25—3 inches, broadly ovate, cordate, acuminate, irregularly and coarsely toothed, rarely 3-lobed, pale and minutely pubescent on both surfaces, base 7—9-nerved. Petiole 1—3 inches long. Flowers about 1 inch diameter, yellow, axillary, solitary, often forming panicle-like terminal inflorescences due to the reduction of the leaves. Peduncles slender ·5—2·5 inches long, jointed near the top. Fruit ·6—1·2 inches across the truncated or flattened upper portions of the carpels. Carpels usually 15—20, very shortly awned on the shoulders, stellately hairy; brown.

Occurs along the subhimalayan tract. It grows on waste ground near villages and appears to be rather scarce. Flowers during the rainy season and cold weather.

2. **Abutilon polyandrum**, W. and A.—An erect herb 3—6 feet high, doubtfully sometimes shrubby. Leaves 3—8 by 2—6 inches, broadly ovate, deeply cordate, acuminate, with irregular shallow blunt teeth, densely stellate-pubescent on both surfaces, base 7—9-nerved. Petiole 1—6 inches long. Flowers 1·2—1·5 inches diameter, orange or yellow, in lax leafy axillary and terminal panicles. Peduncles 1—3·5 inches long, jointed a short distance below the flower. Fruit about ·7 inch across the top of the carpels. Carpels 5—7, shortly awned, tomentose.

Occurs along the subhimalayan tract and in the central and outer hill ranges up to 4,500 feet. There are no specimens from our area at Dehra Dun, though there are several at Kew. Flowers: August—December.

4. URENA. *Linn.*

Perennial herbs and undershrubs, covered with harsh tomentum. Leaves angled or lobed, with a large gland at the base of the midrib below. Flowers sessile or shortly pedicelled; involucrel bracts 5, connate at the base, adnate to the calyx-tube. Sepals 5, connate below into a campanulate tube. Petals 5, united below to the staminal tube. Stamens united into a narrow tube, bearing sessile or shortly stalked anthers below the apex. Ovary of 5 1-ovuled cells; style-branches 10; stigmas capitate. Ripe carpels 5, smooth or covered with glochidiate spines, indehiscent.

Carpels echinate. Leaves angled or somewhat lobed 1. *lobata*.

Carpels smooth. Leaves entire or rarely lobed ... 2. *repanda*.

1. ***Urena lobata*, *Linn.***—An erect deciduous shrub 2—8 feet high with stem up to 1 inch diameter. Branches tomentose with spreading stellate hairs. Bark fairly smooth, reddish-brown, lenticellate, the inner greenish bast very tough and fibrous. Leaves variable; the basal usually broader than long, suborbicular, cordate, up to 6 inches across; the upper often rhomboid and smaller; all finely and irregularly serrate, 3—10-angled or -lobed, lobes acute obtuse or sometimes obsolete, softly stellate-hairy on both sides, base 5—7-nerved, nerves prominent beneath, the 3 central or midrib only with an oval gland. Petiole 5—6 inches long, hairy. Flowers 7—1.25 inches diameter, pink with a darker centre, 1—3 together, axillary. Peduncles up to 1 inch long, hairy. Fruit depressed-globose, brown, 3—5 inch diameter including the spines. Carpels rounded on the back, densely stellate-hairy, covered with blunt spines each tipped by a whorl of 2—5 backward-directed bristles.

Occurs throughout the area up to 5,000 feet. Common in most types of forest and often abundant in *sal* forests in the Bhabar. Flowers: June—October. Fruit: October–November.

2. ***Urena repanda*, *Roxb.***—An erect deciduous undershrub with scarcely woody sparingly branched stems 4—6 feet high and up to 6 inch diameter. Stems often cæspitose. Branches densely clothed with spreading stellate hairs. Inner bast very tough. Leaves variable in size and shape; the uppermost smaller and lanceolate; the lower up to 3.5 inches diameter, roundish, rarely somewhat lobed, irregularly denticulate, apex acute, base rounded or cordate, densely stellate-hairy on both surfaces, nerves prominently reticulate beneath with a gland near the base of the midrib, base 5—7-nerved. Petiole up to 3 inches long. Flowers 5—1 inch diameter, pink, 1-2 together, axillary, in leafless or

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leafy terminal racemes. Peduncles 1—3 inch long. Involucral bracts united into a cup below, linear-subulate above. Fruit about .35 inch diameter enclosed within the persistent bracts and calyx. Carpels smooth, unarmed.

Occurs in grassy *choars* in the subhimalayan tract of the Haldwani Division at about 700 feet elevation, but it is scarce and has not been recorded further west. Flowers : September-October. Fruit : December.

5. HIBISCUS, *Medik.*

Herbs, shrubs or rarely trees. Leaves stipulate, usually palmately lobed or cut. Flowers axillary, or rarely in a terminal raceme. Bracteoles 4—12 or rarely 0, usually free from each other and from the calyx. Calyx 5-lobed or 5-fid, valvate or spathaceous or circumsciss. Petals 5, connate at the base and adnate to the staminal tube. Staminal tube truncate or 5-toothed at the top, giving off the free ends of the stamens at various heights. Ovary 5-celled; ovules 3 or more in each cell; styles 5, connate below. Capsule loculicidally 5-valved.

Flowers 1—3 together on long peduncles. Capsule
glabrous ... 1. *Lampas*.

Flowers in terminal racemes. Capsules hairy ... 2. *pungens*.

1. **Hibiscus Lampas**, *Cav.* Syn.—*Thespesia Lampas*, Dalz. and Gibs. and *T. macrophylla*, Blume. Vern. *Ban-kapāsi*, R.—An erect sparingly-branched deciduous shrub 4—8 feet high with stems up to .75 inch diameter. Bark reddish-brown, smooth, lenticellate. Blaze .05 inch, very fibrous, greenish. Young shoots more or less densely clothed with brown stellate hairs. Leaves 4—8 by 3.5—7 inches; the lower usually more or less deeply 3-lobed and cordate; the upper often entire and ovate; all acuminate, stellate-hairy on both surfaces when young but more densely beneath, usually glabrescent above when mature, midrib with a glandular pore beneath near the base, base 5—7-nerved, nerves prominent beneath. Petiole .3—4.5 inches long, hairy. Flowers 3-4 inches diameter, yellow with a crimson centre, 1-3 together at the end of a long axillary or terminal peduncle. Pedicels up to .3 inch long. Peduncles up to 6 inches long. Capsule .8—1.2 inches long, ovoid, pointed, 4-5- usually 5-valved, woody, dull black. Seeds many, dark brown, about .15 inch long.

Occurs throughout the subhimalayan tract and in the outer hills up to 3,500 feet. Fairly common in dry miscellaneous forest and in openings in *sal* forest. Flowers : August-September. Fruit : January-February.

2. **Hibiscus pungens**, *Roxb.*—An erect, sparingly-branched deciduous shrub 5—10 feet high with woody, often hollow, perennial stems up to 1.75 inches diameter. Bark smooth. Blaze .1-.2 inch, very fibrous, greenish with a very slimy juice. Stems clothed when young

with spreading irritating bristles. Leaves rather variable, usually 5—12 inches diameter, sub-orbicular, cordate, often deeply 5—7-lobed or -partite, or merely angled, lobes crenate or serrate, with rather long scattered hairs on both surfaces; uppermost often 3-partite. Lower petioles up to 18 inches long, exceeding the blade; upper shorter. Flowers 3—5 inches diameter, yellow with a dark purplish-red eye, in terminal racemes 6—30 inches long, the lower flowers usually axillary. Peduncles 1-2 inches long, bristly. Bracteoles 4—6, oblong-lanceolate, acute, .75-1.2 inches long, persistent, hirsute, sometimes glandular. Calyx up to 1.75 inches long, spathaceous, hairy. Capsule 1.5-2.5 inches long, oblong, hirsute within and without. Seeds many, .15 inch long, reniform, dark brown with numerous parallel curved puberulous striations.

Probably occurs throughout the hills between 2,000 and 5,000 feet. I have only seen specimens from Gonai in the Almora District. Flowers: July—October. Fruit: December-January.

6. KYDIA, Roxb.

Trees with stellate tomentum. Leaves palminerved and usually lobed. Flowers paniced, polygamous; bracteoles 4—6, accrescent and spreading in fruit and forming dry spatulate wings. Sepals 5, divided to the middle, persistent in fruit. Petals normally 5. Anthers in clusters of 3-4 at the ends of 5 slender prolongations of the staminal tube or in female flowers reduced or 0. Ovary with usually three 2-ovuled cells; style with 3 branches. Capsule 3-celled, loculicidal.

Kydia calycina, Roxb. Vern. *Pillu*, NG. *Pulão*, SG. *Pūla*, R. *Pātā*, A.—A small or medium-sized deciduous tree up to 6 feet girth and 60 feet high. Bark pale brown often mixed with blackish portions, slightly rough, exfoliating in thin narrow woody strips. Blaze .35—.75 inch, soft, fibrous, pale yellow or whitish tinged pink towards the exterior, with a slimy sticky juice. Young parts stellately tomentose. Leaves 3—6 inches broad, sub-orbicular, sinuate, usually more or less 3—7-lobed, base cordate rarely rounded or cuneate, palmately 7-nerved, glabrous or nearly so above, hoary-tomentose beneath, the 3 central nerves or midrib only with a glandular pore near the base on the lower surface. Petiole 1—3 inches long, tomentose. Flowers .5—.7 inch diameter, white, in many-flowered axillary and terminal tomentose panicles. Pedicels .2—.4 inch long. Bracteoles .25—.4 inch long in fruit. Capsule .2 inch diameter, subglobose, 3-valved, mealy-tomentose.

Occurs throughout the area up to 4,500 feet. Common both in miscellaneous and sal. forests. Flowers: July—October. Fruit: November—March.

7. BOMBAX, *Linn.*

Trees with buttressed trunks. Leaves digitate; stipules small. Flowers out before the leaves appear, clustered towards the ends of the branchlets; bracteoles 0. Calyx leathery, cup-shaped, irregularly lobed. Petals 5. Stamens polyadelphous, very numerous. Ovary 5-celled; ovules numerous in each cell; style clavate, dividing into 5 stigmatic branches at the top. Capsule dehiscent by 5 leathery or woody deciduous valves. Seeds embedded in long white wool.

Bombax malabaricum, DC. Vern. *Simal* or *Semal*, Gen. Eng. The Cotton Tree.—A large deciduous tree up to 130 feet high and 20 feet girth above the buttresses. Stem usually buttressed at the base to a height of 10 or 15 feet. Bark varying from pale ashy to silvery-grey, smooth up to middle age but becoming rough on old trees with shallow vertical fissures and sometimes a few long deep ones. Young stems covered with straight stout spines up to .5 inch long with woody conical bases. Blaze 1.2—3.5 inches, rather soft and fibrous, pink with or without bands of paler tissue. Branches in whorls. Leaflets 5—7, 4—8 inches long, lanceolate, acuminate, base acute, entire, glabrous. Petiole 4—12 inches long. Petiolules .4—1 inch long. Flowers 4—5 inches diameter on short thick pedicels clustered towards the ends of the branches. Petals fleshy, crimson or orange. Capsule 4—6 inches long, oblong-ovoid, woody, downy without and lined with white silky hairs within.

Occurs throughout the subhimalayan tract and central and outer hills up to 5,000 feet. Generally scarce in the hills but very common in the Bhabar especially on open grazing grounds and in miscellaneous forest. Flowers: January—March. Fruit: April—May.

XIV.—STERCULIACEÆ.

Herbs, shrubs or trees, the herbaceous parts usually clothed with stellate hairs. Leaves alternate, simple or digitate, entire toothed or lobed, usually stipulate. Flowers usually in axillary cymes, rarely zygomorphic, 1- or 2-sexual. Sepals valvate, more or less connate. Petals 5 or 0. Stamens 5-many; filaments united into a tube or rarely free; anthers 1—5 together, on or between the teeth of or irregularly arranged in one or more whorls on the outside of the tube; staminodes 5 or 10, coordinate with the stamens or 0. Ovary usually 4-5-celled or reduced to a single carpel; ovules 2-many in each cell; styles distinct or connate. Fruit often a 5-valved loculicidal capsule, sometimes of 1—6 spreading or spirally twisted follicles, rarely dividing into cocci or baccate.

Trees. Petiole exceeding 4 inches. Petals wanting ... 1. *Sterculia*.

A shrub. Petiole less than 1 inch long. Petals present ... 2. *Helicteres*.

1. STERCULIA, Linn.

Trees. Leaves undivided, lobed or digitate. Flowers in panicles, 1-sexual or polygamous. Calyx 4-5-fid or -partite. Petals 0. Staminal column bearing 10—30 anthers at its apex. Ovary of 5 nearly distinct carpels; ovules 2-many in each carpel; styles connate below. Ripe carpels distinct, follicular, sessile or stalked.

I.—Leaves tomentose beneath.

1. Leaves usually deeply 5—7-lobed, upper surface smooth. Follicles woody ... 1. *villosa*.

2. Leaves usually obscurely 3-lobed, upper surface rough. Follicles membranous ... 2. *pallens*.

II.—Leaves glabrous or with a few scattered stellate hairs beneath, upper surface smooth ... 3. *colorata*.

1. *Sterculia villosa*, Roxb. Vern. *Udāla* or *Udiāl*, Gen. *Wadāla* NG.—A small or medium-sized deciduous tree up to 40 feet high and 6 feet girth. Branches smooth, pale grey, lenticellate. Bark roughish, sometimes with shallow cracks. Blaze deep pink or pinkish-brown. Leaves usually 10—18 inches diameter sometimes up to 24 inches, about as long as broad, crowded at the ends of the stout branches, cordate, deeply 5—7-lobed, lobes abruptly acuminate entire or sometimes again 3-lobed, glabrescent or thinly stellate-hairy above, velvety pubescent with spreading hairs intermixed beneath, base 5—7-usually 7-nerved. Petiole usually 12—18 inches long, sometimes up

to 24 inches. Flowers .5—7 inch diameter, pale yellow streaked inside with pink, polygamous, in rusty-tomentose panicles 3—12 inches long, the panicles fascicled at the ends of the leafless shoots. Calyx-tube as long as or shorter than the spreading lobes which are glabrous inside. Fruit of 3—5 distinct spreading sessile follicles, 2.25 by 1.15 inches, oblong, coriaceous, clothed especially without with stiff stellate hairs, bright red when ripe. Seeds .4 inch long, ellipsoid, shining, black.

Occurs throughout the area up to 4,500 feet. Common in miscellaneous forest especially in the Bhabar and on southern aspects in the outer hills. Flowers: February—April. Fruit: May, whilst the tree is still leafless.

2. *Sterculia pallens*, Wall. Vern. *Budalla* or *Bōdala*, Gen. *Bōla*, EA.—A small deciduous tree up to 4 feet girth and 50 feet high. Bark smooth, pale ashy-brown or silvery-grey. Blaze .7-1.3 inches, white with anastomosing bands of very fibrous cellular pale yellow tissue more abundant towards the interior. Leaves 5.5—10 by 6.5—12 inches, cordate, usually somewhat obscurely 3-lobed, sometimes 5-lobed or entire, base strongly 5—9- usually 7-nerved, upper surface rather rough with scattered stellate hairs, lower surface clothed with dense, soft, velvety, pale yellow, stellate pubescence. Petiole 4—12 inches long, stellately tomentose. Flowers .5—7 inch diameter, pale yellow, in rusty-tomentose axillary panicles 2—6 inches long, approximate towards the ends of the leafless shoots. Calyx-tube longer than the lobes. Fruit of 2—5 spreading stipitate follicles. Stipe .2—5 inch long, usually curved. Follicle membranous, opening long before maturity, when opened pale yellowish-brown, flat, strongly reticulate-veined, oblong, 2—4 inches long with a seed attached to the margin below the middle.

Occurs throughout the area up to 4,500 feet. Fairly common in open miscellaneous forest, less frequent in *sal* forest. Flowers: February—April. Fruit: April—June.

3. *Sterculia colorata*, Roxb.—A large or medium-sized deciduous tree up to 12 feet girth and 70 feet high, often buttressed at the base. Bark pale grey or brown, fairly smooth. Blaze .9—1.2 inches, white, cheesy with ramifying bands of fibrous yellow tissue. Leaves 6—12 inches across, usually broader than long, crowded at the ends of the branches, cordate, deeply 5—7-lobed or -partite on young plants, usually shallowly 3-lobed on old trees, lobes caudate, thinly coriaceous, pubescent when young, glabrous or nearly so when mature, base 7-nerved. Petiole 3—10 inches long, slender, terete. Flowers .3-.4 inch diameter, orange-red, in densely stellate-tomentose panicles 2-3 inches long, the panicles approximate at the ends of the leafless shoots. Calyx .6-.7 inch long, funnel shaped; lobes erect, about one-fifth the length of the tube, stellately hairy within as well as without. Follicles 2-3 inches long, stalked,

membranous, glabrous, opening long before maturity and bearing one seed on one or both of its margins.

This species occurs, though rarely, in the subhimalayan tract towards the extreme east of the Haldwari Division, but has not been recorded west of the Nandhaur river. It is found in miscellaneous forest. Flowers: March-April. Fruit: April-May.

2. *HELICTERES*, Linn.

Trees or shrubs, more or less stellately pubescent. Leaves entire or serrate. Flowers axillary, solitary or fascicled. Calyx tubular, 5-toothed at the apex, teeth often unequal. Petals 5, equal or unequal. Staminal column elongated, adnate to the gynophore, 5-toothed or -lobed; anthers 5—10, in groups at the top of the column between the teeth. Ovary 5-lobed, 5-celled, at the top of the column; styles 5, more or less united. Follicles spirally twisted or straight.

***Helicteres Isora*, Linn.** Vern. *Marorphal*, Gen. *Bēnwa*, H.—A subdeciduous shrub with spreading branches and stems up to 15 feet high and 5 inches diameter. Bark fairly smooth and thinly corky. Blaze 3-4 inch, very fibrous, pale yellow turning orange on exposure. Young parts stellately hairy. Leaves 3—9 by 2—8 inches, distichous, oblong, obovate or orbicular, shortly acuminate, sometimes 3-lobed, obliquely cordate or rounded at the base, serrate, scabrous above, densely stellate-pubescent beneath, with 4—7 basal nerves. Petiole 2-7 inch long. Flowers 1-1.5 inches long, solitary or in few-flowered axillary or extra-axillary clusters, zygomorphic. Calyx greenish-yellow. Corolla at first pink or red with spreading lobes, later the lobes are reflexed approximate to the calyx-tube and the terminal portion turns leaden grey whilst the basal portion turns greenish-yellow. Fruit 1.5-2 inches long, cylindric, composed of 5 spirally twisted carpels on a long gynophore.

Occurs throughout the subhimalayan tract and outer hills up to 3,000 feet. Common and often gregarious. Liable to be mistaken for a *Grewia* when not in flower or fruit. Flowers: March—August. Fruit: October—January.



XV.—TILIACEÆ.

Trees shrubs or herbs, usually with mucilaginous juice. Leaves usually alternate, simple or lobed, usually stipulate. Flowers regular, hermaphrodite or rarely 1-sexual, usually in cymes. Sepals 3—5, free or connate, usually valvate. Petals 3—5 or 0, inserted round the base of the torus, contorted imbricate or valvate. Stamens usually indefinite, inserted on a torus; filaments free or sometimes 5—10-adelphous, but not united into a tube. Ovary free, 2—10-celled; ovules 1-many; style entire, divided or 0. Fruit 2—10-celled, or by false septa many-celled, often drupaceous.

I.—Fruit without bristles or spines, indehiscent ... 1. *Grewia*.

II.—Fruit densely clothed with bristles or spines.

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|-----------|-----|-----|-----|-----|--------------------------|
| 1. Trees | ... | ... | ... | ... | 2. <i>Echinocarpus</i> . |
| 2. Shrubs | ... | ... | ... | ... | 3. <i>Triumfetta</i> . |

1. GREWIA, *Linn.*

Trees or erect straggling or climbing shrubs, usually stellately pubescent. Leaves alternate, 3—7-nerved. Flowers usually yellow, in axillary extra-axillary or terminal cymes, fascicles or panicles. Sepals 5, distinct. Petals 5, usually with a gland at the base within, generally shorter than the sepals, very rarely 0. Stamens numerous, inserted on a short or elongated often glandular torus. Ovary 2—4-celled; ovules 2-several in each cell; style 1; stigma 2—5-lobed or lacinate. Fruit of 1—4 pyrenes, entire or 2—4-lobed. Pyrenes usually 1- or 2-seeded.

I.—Small or medium-sized trees.

A. Leaves 3-nerved.

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|--|-----|-----|-----|---------------------------|
| 1. Leaves ovate, pubescent. Inflorescence leaf-opposed | ... | ... | ... | 1. <i>oppositifolia</i> . |
| 2. Leaves oblong or lanceolate, glabrescent. Inflorescence axial | ... | ... | ... | 2. <i>lævigata</i> . |

B. Leaves 5—7-nerved.

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|---|-----|-----|------------------------|
| 1. Leaves more or less persistently whitish beneath, base not cordate | ... | ... | 3. <i>elastica</i> . |
| 2. Leaves green beneath, base usually cordate | ... | ... | 4. <i>Hainesiana</i> . |

II.—Shrubs up to 5 feet high.

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|--|-----|-----|--------------------------|
| 1. Leaves 2—4 inches broad, the basal pair of nerves next to the midrib reaching almost to the end of the leaf | ... | ... | 5. <i>sapida</i> . |
| 2. Leaves 3—6 inches broad, the same basal pair of nerves reaching to the middle of the leaf | ... | ... | 6. <i>sclerophylla</i> . |

1. *Grewia oppositifolia*, Roxb. Vern. *Bhimal*, Gen. *Bhiyul*, G.—A small or medium-sized tree up to 4·5 feet girth and 45 feet high. Bark dark brown, roughish, exfoliating in small woody scales. Branches smooth, pale silvery-brown. Blaze 4—8 inch, rather fibrous, pale yellow often tinged pink towards the exterior, juice slimy. Leaves 2—5 by 1·2—2·5 inches, ovate, acuminate, closely serrate, the teeth small and blunt, scabrid with stellate hairs on both surfaces; base rounded, not or slightly oblique, 3-nerved. Petiole 1—4 inch long, tomentose. Flowers 1—8 together. Peduncles solitary, leaf-opposed or exceptionally a few axillary, 3—7 inch long, tomentose. Pedicels 3—7 inch long, pubescent. Sepals green outside, white or pale yellowish inside. Petals white. Fruit 1—4-lobed, each lobe about 25 inch diameter, greenish-black, glabrous or with scattered hairs.

Occurs throughout our area between 1,000 and 4,000 feet. It is very commonly planted and cultivated in the hills between fields on account of its valuable fodder and fibre. Fairly common also in a wild condition. Flowers: April—June. Fruit: October—December.

2. *Grewia laevigata*, Vahl. Vern. *Gar-bhimli*, R.—A small tree up to 15 feet high and 2 feet girth. Bark smooth, pale brown. Blaze 2—4 inch, pale yellow or white with narrow darker fibrous bands, juice slimy and sticky. Leaves 3—7 by 1·2—2·5 inches, elliptic-oblong or lanceolate, long-acuminate, serrate, thin, nearly glabrous above, more or less stellately hairy beneath; base narrowed, 3-nerved. Petiole 2·3 inch long. Flowers white, 2—6 on each peduncle. Peduncles axillary, solitary or 2-3 together, slender, 7—1 inch long. Pedicels 5—7 inch long. Sepals 5·6 inch long. Petals less than one-third the length of the sepals. Fruit 1—4-lobed, lobes 2 inch across, connate in pairs when 4 are developed, greenish-black when ripe, the seeds surrounded by a dark orange-brown pulp.

Occurs throughout the subhimalayan tract and outer hills up to 4,000 feet. Fairly common in open miscellaneous forests of the Bhabar. Flowers: June—September. Fruit: December—March.

3. *Grewia elastica*, Royle. Syn. *G. vestita*, Wall. *G. asiatica*, Brandis *ex parte*. Vern. *Pharsain*, NT and H.—A small or medium-sized tree. Bark dark brown or blackish, usually with silvery patches, fairly smooth exfoliating in thick woody scales. Blaze 5—8 inch, fibrous, bright or pale pink (orange when young) usually with a few paler bands. Juice viscid, turning purple on the blade of a knife. Young shoots and petioles densely brown-tomentose. Leaves 2—7 by 1·5—4 inches, oblong ovate or elliptic, acuminate, serrulate, base obliquely rounded but not cordate, more or less stellately pubescent above and whitish-tomentose beneath when young, ultimately glabrescent above, usually persistently whitish

beneath; base 5—7-nerved, nerves prominent beneath. Petiole .2—·5 inch long, stout, tomentose, usually thickened towards the top. Flowers .5—·6 inch diameter. Peduncles up to .8 inch long, axillary, clustered several together, rarely solitary, villous. Pedicels 2-3 together, up to .5 inch long, villous. Sepals and petals yellow fading pinkish. Sepals tomentose without, sparsely hairy within. Petals half or less than half as long as the sepals, glabrous. Gynophore present or absent. Fruit .25 inch diameter or less, globose or indistinctly lobed.

Occurs throughout the subhimalayan tract and outer hills up to 5,000 feet. Fairly common. Flowers: May-June.

A distinct variety is that described by Wallich as *G. vestita*. This is distinguished by the leaves becoming green beneath when mature and by general less hairiness. I am doubtful whether it is found within our area.

4. *Grewia Hainesiana*, Hole. Syn. *G. asiatica*, Roxb. non Linn. Vern. *Pharsula*, *L. Dhāman*, *K. Bhimal*, H.—A small tree or sometimes only a shrub. Shoots tomentose. Bark smooth. Leaves 4—7 by 3—6 inches, broadly ovate or sub-orbicular, obtuse or shortly cuspidate, base cordate or rounded, regular or oblique, 5—7-nerved, nerves prominent beneath, margin finely serrate, teeth obtuse, more or less densely tomentose with stellate hairs on both surfaces, ultimately glabrescent, undersurface green. Petiole .3—·7 inch long, densely tomentose at first, thickened towards the top. Flowers about .75 inch diameter. Peduncles up to .8 inch long, axillary, clustered several together, rarely solitary, tomentose. Pedicels 2-3 together, up to .5 inch long, tomentose. Sepals whitish and densely hairy outside, yellow and glabrous inside. Petals yellow, half or less than half as long as the sepals. Gynophore long. Fruit .3—·5 inch diameter, globose, of 1-2 pyrenes.

Occurs throughout the area up to 3,000 feet. Common. Flowers: April-May. Fruit: June—August.

5. *Grewia sapida*, Roxb. Vern. *Phālsa*, Gen.—A small shrub 1—3 feet high with annual or perennial shoots up to .25 inch diameter from a woody rootstock. Leaves 2—5.5 by 2—4 inches, broadly oblong, obovate or sub-orbicular, apex rounded, abruptly short-acuminate or acute, serrate with blunt teeth, base regular or oblique and rounded or cuneate but not cordate, 5—7- usually 5-nerved, nearly glabrous or scabrous above, pubescent or nearly glabrous beneath. Petiole .1—·5 inch long, stout, tomentose, without any conspicuous glands at the top. Flowers yellow, about .5 inch diameter. Peduncles axillary, .5—1.2 inches long, slender, 1—5 together, usually 3-flowered, hispid. Pedicels .3—·5 inch long. Fruit .25 inch diameter, sometimes slightly lobed, stellately hairy.

Occurs throughout the subhimalayan tract and outer hills up to 4,500 feet. Common in grassy blanks in *sal* forest and in areas annually burnt. Flowers: April-May. Fruit: October-November.

6. *Grewia sclerophylla*, Roxb. Syn. *G. scabrophylla*, Roxb. Vern. *Phālsa*, H.—A shrub with woody rootstock, sending up annual woody stems from the base which attain 2—5 feet high. Leaves 4—7 by 3—6 inches, broadly elliptic or sub-orbicular, sometimes slightly lobed, irregularly serrate or denticulate, the larger teeth glandular-tipped, base usually oblique, cuneate rounded or slightly cordate, 3—5-nerved but only 3 strong nerves, scabrid above, densely stellate-pubescent and usually whitish or pale grey beneath. Petiole .2—6 inch long, very stout, tomentose, usually with several pairs of large glands near the top and on the margin of the blade. Flowers white, about 1 inch diameter, 2-3 together on each peduncle. Peduncles axillary, solitary or clustered, up to .5 inch long, stout, tomentose. Pedicels up to .5 inch long, stout, tomentose. Fruit .7—1 inch diameter, globose, not lobed, purple, crustaceous, hairy.

Occurs throughout the subhimalayan tract and outer hills up to 3,500 feet. Common in open grassy areas in sal forest. Flowers: August-September. Fruit: November-January.

2. *ECHINOCARPUS*, Blume.

Trees. Leaves simple. Flowers axillary, solitary or clustered. Sepals 4-5, imbricate. Petals 4-5, variously cut. Stamens numerous, free, arising from a thick disk. Ovary 3—6-celled; ovules many in each cell; style subulate. Capsule coriaceous or woody, prickly or setose, 3—6-celled or by abortion fewer.

Echinocarpus tomentosus, Benth.—A medium-sized evergreen tree. Bark smooth, grey. Twigs tomentose. Leaves 6—11 by 3—5 inches, obovate or broadly elliptic, shortly and abruptly acuminate, base rounded or cuneate, serrulate with apiculate teeth in the upper two thirds or entire, coriaceous, rusty tomentose on both surfaces when young, ultimately glabrescent and shining above; lateral nerves 10—12 pairs, prominent beneath. Petiole .4—1.5 inches long, tumid and somewhat glandular beneath at its junction with the leaf, tomentose. Flowers about 1 inch diameter, solitary in the axils of undeveloped leaves towards the bases of the new shoots. Peduncles tomentose, 1—1.5 inches long. Sepals ovate, villous on both sides. Petals twice the length of the sepals, broadly truncated and irregularly cut into teeth at the apex, with numerous parallel pubescent nerves. Capsule about 1.5 inches diameter, ovoid, woody, 5-valved, the valves densely clothed without with erect bristles .15—2 inch long in the mature fruit. Seeds smooth, brown, .4 inch long.

Occurs in the central hill ranges between 3,000 and 5,000 feet. Rare and only recorded from Sirkot in Garhwal. Local in Almora. It is usually found growing in ravines. Flowers: April. Fruit: September.

3. TRIUMFETTA, Linn.

Herbs or undershrubs with stellate pubescence. Leaves usually serrate, sometimes 3—5-lobed. Flowers yellow, axillary or leaf-opposed, few or densely cymose. Sepals 5, distinct. Petals 5, rarely 0, glandular. Stamens indefinite, rarely 5 or 10, inserted on the glandular torus, free. Ovary 5-celled; cells 2-ovuled; style filiform; stigma 2—5-toothed. Capsule globose or ovoid, echinate or setose, indehiscent or separating into cocci. Seeds 1-2 in each cell.

Lower leaves ovate, not lobed. Ripe fruit including the
spines .6-.7 inch diameter 1. *pilosa*.

Lower leaves rounded, usually 3-lobed. Ripe fruit includ-
ing the spines .2-.3 inch diameter 2. *rhomboidea*.

1. **Triumfetta pilosa**, Roth. Vern. *Kūra*, NG.—An erect deciduous shrub 2—8 feet high with stem up to 1 inch diameter. Bark pale brown, smooth, with numerous small lenticels. Blaze .1 inch, very fibrous, greenish. Twigs clothed with stellate hairs with red bulbous bases. Leaves alternate, the upper ones gradually diminishing in size and narrower. Lower leaves up to 5 by 2.25 inches, ovate, irregularly serrate, gradually tapering to an acuminate point, base rounded or subcordate, 5-nerved, rather harshly stellate-hairy on both surfaces. Petiole .5—1.5 inches long, with bulbous-based stellate hairs like the stem. Flowers .3 inch diameter, in few-flowered axillary and leaf-opposed fascicled cymes up to .5 inch long. Peduncle and pedicels hairy. Petals ligulate, yellow, .25 inch long. Stamens yellow. Fruit including the spines .6—7 inch diameter. Spines .2—.25 inch long, hooked, hispid in the lower half and dilated near the base. Capsule dehiscent. Seeds shining, glabrous, .1 inch long.

Occurs throughout the area up to 6,000 feet. Fairly common on waste ground or amongst scrubby undergrowth especially on hot dry slopes. Flowers: June—October. Fruit: October—January.

2. **Triumfetta rhomboidea**, Jacq.—An erect subdeciduous shrub 2—6 feet high with stem up to .75 inch diameter, or herbaceous when small. Bark reddish-brown. Twigs slender, pubescent usually with simple hairs without bulbous bases. Leaves alternate, variable in size and shape; the lower 2-3 inches diameter, usually 3-lobed, irregularly serrate, clothed with simple and stellate hairs on both sides and with simple hairs on the nerves beneath, base cordate or cuneate, 5-nerved; the upper usually entire; the uppermost much smaller and lanceolate. Petiole up to 1.5 inches long, more or less hairy. Flowers .3 inch diameter, in dense axillary and leaf-opposed cymes, solitary or fascicled and forming a long terminal spike-like inflorescence. Sepals ligulate, hooded and apiculate at the apex. Petals .15 inch long, yellow. Fruit

including the spines .2—.3 inch diameter. Spines .05 inch long, hooked, glabrous.

Occurs throughout the area up to 5,000 feet. Abundant on grazing grounds and in dry miscellaneous forest. Flowers: June—October. Fruit: October—February.

XVI.—LINACEÆ.

Herbs shrubs or rarely trees. Leaves alternate, simple, usually entire; stipules lateral, intrapetiolar or 0. Flowers regular, bisexual, often 2-or more-morphic. Sepals 5, rarely 4, free or connate at the base, imbricate. Petals as many as the sepals, hypogynous or slightly perigynous, imbricate. Stamens 1-2 or rarely 3 times as many as the petals, occasionally with interposed staminodes, united at the base into a ring or short tube; filaments usually filiform; anthers versatile. Disk 0 or of (usually) 5 entire or 2-lobed glands, adnate to the staminal tube. Ovary free, entire, 3—5-celled; ovules 1-2 in each cell; styles 3—5, free or connate; stigmas usually terminal. Fruit a septicidal capsule, splitting into as many or twice as many valves as there are cells to the ovary, or a drupe.

REINWARDTIA, *Dumort.*

Undershrubs. Leaves membranous, usually serrate; stipules minute, caducous. Flowers large, yellow or white, in short axillary racemes or in terminal corymbs; pedicels bracteate. Sepals 5. Petals 5, contorted. Stamens 5, connate at the base, alternating with setiform staminodes. Glands 2-3, adnate to the staminal tube. Ovary of 3—5 cells, each cell 2-locellate; ovule 1 in each locellus; styles 3-4 rarely 7, filiform. Capsule globose, 6—8-valved.

Reinwardtia trigyna, *Planch.* Vern. *Piunli* or *Piuli*, Gen.—An erect deciduous glabrous shrub, usually 1-3 feet high but up to 8 feet with stems .75 inch diameter. Bark fairly smooth, pale yellowish-greenish-brown, lenticellate. Blaze .05 inch, greenish, not fibrous. Leaves 1—4 inches long, elliptic-lanceolate or oblanceolate, acute, decurrent into a short petiole, entire or minutely crenate-serrate, glabrous, mucronate, pale beneath. Flowers mostly solitary and axillary, yellow, showy, sweet-scented, about 1.5 inches diameter. Stamens in some flowers shorter in others longer than the style. Capsule .3 inch diameter, depressed-globose, striped alternately green and dirty yellow before ripening, brown when ripe.

Occurs throughout the area between 1,000 and 7,000 feet. Found in most localities especially in *banj* forest where it is often common. Flowers: December—March. Fruit: April—June.



XVII.—MALPIGHIACEÆ.

Trees or erect or climbing shrubs. Leaves usually opposite and entire; stipules small or 0. Flowers bisexual, often irregular; pedicels jointed, bracteate. Sepals usually 5, imbricate, one or more usually furnished with large glands. Petals 5, usually equal, fimbriate or dentate, often clawed. Disk small. Stamens usually 10, 1 or more sometimes much longer than the others; filaments free or connate at the base. Ovary 3-celled; cells 1-ovuled; styles 1—3. Fruit of 1 or more winged samaras, rarely a drupe.

Style 1; petals unequal	...	...	...	1. <i>Hiptage</i> .
Styles 3; petals equal	...	...	...	2. <i>Aspidopterys</i> .

1. HIPTAGE, *Gærtn.*

Climbing shrubs or rarely small trees. Leaves opposite, coriaceous, entire, eglandular, exstipulate. Racemes terminal and axillary; peduncles bracteate. Flowers with 4 white and one coloured petal, fragrant. Calyx 5-partite with one large gland partly on the pedicel. Petals clawed, unequal. Stamens 10, curved, one much longer than the others; filaments connate at the base. Ovary 3-lobed; styles 1-2, coiled; stigma capitate. Fruit of 1—3 winged samaras.

Hiptage Madablota, *Gærtn.* Vern. *Anētha*, *G* and *R*.—A large evergreen dextrorse climber with rambling stems up to 4 inches diameter and 40 feet high. Bark slightly rough, dark reddish-brown. Blaze .2-.3 inch, hard, fibrous next the wood only, pale yellow densely streaked and mottled with orange and sometimes tinged pink. Branches smooth, grey, with numerous minute lenticels. Leaves opposite, 4—8 by 1.75-2.75 inches, elliptic-lanceolate or oblong, acuminate, entire, glabrous except when quite young, thinly coriaceous, two glands on the margin of the leaf near the base one on either side of the midrib, secondary nerves 5—8 pairs, very glossy and usually tinged pink when young, glossy dark green above and pale and glossy beneath when mature. Petiole .2—.4 inch long, deeply channelled. Flowers .75—1 inch diameter, fragrant, in pubescent axillary racemes 1—6 inches long sometimes forming terminal panicles. Petals orbicular, fimbriate, white, the upper one yellow in the centre. Fruit of 1—3 samaras, each with 3 obovate or oblanceolate wings, one 1.5—2 inches long, the other two smaller.

Occurs throughout the area up to 3,500 feet. Fairly common in moist rocky ravines and in swampy localities. Flowers: March-April. Fruit: April—June.

2. ASPIDOPTERYS, *A. Juss.*

Climbing shrubs. Leaves entire, eglandular, exstipulate. Flowers paniced or fascicled; peduncles bracteate; pedicels slender. Sepals 5, short, eglandular. Petals 5, not clawed, entire, white or yellow. Stamens 10; filaments free or connate at the base. Ovary 3-lobed; styles 3. Fruit of 1—3 samaras surrounded by a shield-like membranous wing.

Aspidopterys Wallichii, *Hook. f.*—A dextrorse climber with stems up to 15 feet high and .5 inch diameter. Twigs, lower surface of the leaves, and inflorescence clothed with white or pale grey tomentum. Leaves opposite, 3—7 inches long, ovate elliptic or sub-orbicular, base rounded or subcordate, shortly acuminate, entire, glabrescent above; lateral nerves prominent beneath, 4—5 pairs, arcuate. Petiole .4—8 inch long. Flowers .3—35 inch diameter, pale greenish-yellow, scented, in long lax terminal panicles the lower branches in the axils of leaves. Fruit of 1—3 samaras. Wing 1—1.5 inches long, oblong-ovate or orbicular, with conspicuous radiating nerves.

Occurs throughout the area between 1,000 and 4,500 feet. Common in open dry miscellaneous or scrub forest. Flowers: July—September. Fruit: October—February.

XVIII.—RUTACEÆ

Trees or shrubs, sometimes climbing, rarely herbs, abounding in pellucid glands filled with essential oil. Leaves opposite or alternate, usually compound, exstipulate. Flowers usually hermaphrodite and regular, in cymes or panicles, rarely in racemes. Calyx of 4-5, rarely 3, small lobes. Petals 4-5, rarely 3, hypogynous, valvate or imbricate. Disk annular, crenate or lobed. Stamens usually either as many or twice as many as the petals; filaments usually free, inserted around the disk; anthers introrse. Ovary of usually 4—5 free or connate carpels; styles as many as the carpels, free or more or less connate; ovules usually 2 in each cell. Fruit a capsule berry or drupe, sometimes splitting into cocci.

I. Armed.

- | | | | | |
|--|-----|-----|-----|-------------------------|
| A. Leaves 1-foliolate | ... | ... | ... | 1. <i>Citrus</i> . |
| B. Leaves trifoliolate | ... | ... | ... | |
| 1. A tree | ... | ... | ... | 2. <i>Aegle</i> . |
| 2. A climber | ... | ... | ... | 3. <i>Toddalia</i> . |
| C. Leaves imparipinnate | ... | ... | ... | |
| 1. Prickles flattened, ultimately raised on a woody pedestal. Fruit capsular | ... | ... | ... | 4. <i>Zanthoxylum</i> . |
| 2. Thorns terete, not raised on a pedestal. Fruit a berry | ... | ... | ... | 5. <i>Limonia</i> . |

II. Unarmed.

- | | | | | |
|---|-----|-----|-----|-----------------------------|
| A. Leaves simple. Stamens 5 | ... | ... | ... | 6. <i>Skimmia</i> . |
| B. Leaves 1-pinnate | ... | ... | ... | |
| 1. Leaflets 1—7. Stamens 8—10. | | | | |
| (a) Leaves glabrous. Style persistent | ... | ... | ... | 7. <i>Glycosmis</i> . |
| (b) Leaves pubescent. Style deciduous. Flowers in terminal panicles | ... | ... | ... | 8. <i>Clausena</i> . |
| 2. Leaflets 3—25. Style deciduous. Flowers corymbose or in few-flowered cymes | ... | ... | ... | 9. <i>Murraya</i> . |
| C. Leaves 2- or 3-pinnate | ... | ... | ... | 10. <i>Bæninghausenia</i> . |

1. CITRUS, Linn.

Evergreen shrubs or trees, usually with axillary thorns. Leaves alternate, 1-foliolate; petiole often winged; stipules 0. Flowers axillary, solitary fascicled or in small cymes. Calyx 3—5-lobed. Petals 4—8, thick, imbricate. Disk large. Stamens numerous, inserted round the disk; filaments irregularly polyadelphous. Ovary many-celled; style

stout; stigma capitate; ovules 4—8 in each cell, 2-seriate. Fruit a large many-celled berry with coriaceous or fleshy rind.

Citrus medica, *Linn.* Vern. *Nimbu*, *Bijora*. Eng. Wild Lemon.—An evergreen shrub 6—12 feet high with stems up to 4 inches diameter. Young shoots glabrous. Bark smooth, yellowish-brown. Blaze .1 inch, pale orange or pale yellow. Branches up to about 2 inches diameter armed with sharp, stout, straight, axillary thorns up to 3 inches long. The branches often procumbent, and rooting freely in contact with the ground. Leaves 3—6 by 1.2-3 inches, oblong or elliptic with acute or rounded apex, rather obscurely crenate-serrate, coriaceous, glabrous, pellucid-punctate, dull dark green above. Petiole .2—.5 inch long, sometimes very narrowly winged. Flowers 1.5—1.75 inches diameter, scented, white tinged pink outside, often unisexual, in few-flowered axillary cymes up to 1 inch long or solitary. Pedicels .15—.25 inch long. Fruit 2-3 inches long, usually obovoid, yellow when ripe, with a leathery rind.

Occurs throughout the subhimalayan tract up to 3,000 feet. Fairly common in swampy or moist localities or in shady ravines, sometimes forming almost impenetrable thickets. Flowers chiefly December—April. Fruit: December—April.

The plant described above is probably truly wild and indigenous within our area. There is a *Citrus* found apparently wild in the Nighol valley of North Garhwal, but no specimens have been collected. The wild form of the orange *C. Aurantium*, *Linn.* has not yet, I believe, been collected within our area. It is said to differ from *C. medica* in the twigs being pale instead of purple, in the petals being without any tinge of pink, and in the flowers being always bisexual.

2. *AEGLÆ*, *Corr.*

Trees, armed with spines. Leaves alternate, 3-foliolate. Flowers hermaphrodite, rather large, white, in axillary panicles. Calyx 4—5-lobed, deciduous. Petals 4—5, imbricate. Stamens numerous, inserted round the disk. Ovary 8—20-celled, the cells peripheral round a thick axis; style short; stigma deciduous; ovules numerous, 2-seriate in each cell. Fruit a large 8—15-celled berry. Seeds numerous, embedded in aromatic pulp.

Aegle Marmelos, *Corr.* Vern. *Bēl*, Gen.—A small or medium-sized deciduous tree up to 4.5 feet girth and 45 feet high, armed with 1-2 straight sharp axillary thorns up to 2 inches long. Bark dark grey, slightly corky, rough, with a few shallow vertical cracks. Blaze .5 inch, hard, pale orange-yellow. Leaves alternate, 3-foliolate, rarely 5-foliolate. Petiole 1-2.5 inches long, terete. Leaflets 2—4 by 1-2.5 inches, ovate or ovate-lanceolate, crenate, acuminate, membranous, pellucid-punctate, the lateral opposite. Petiolule of terminal leaflet up to 1 inch long, of lateral leaflets up to .1 inch long. Flowers about

1 inch diameter, greenish-white, sweet-scented, in lateral and sub-terminal simple pubescent panicles 1·5—3·5 inches long, appearing with the new leaves. Fruit 2-3 inches diameter (larger in cultivated forms), globose or oval, grey or yellowish with a woody rind. Seeds numerous, embedded in a clear mucilage and yellow sweetly-aromatic pulp.

Occurs throughout the area up to 4,000 feet. Common in dry miscellaneous forest especially grazed areas, less frequent in *sal* forest. Flowers: May-June. Fruit: May-June of the following year.

3. TODDALIA, *Juss.*

Shrubs, erect or climbing, generally armed with recurved prickles. Leaves alternate, trifoliolate, the leaflets gland-dotted. Flowers small, unisexual, in cymes or panicles. Calyx short, 5-lobed. Petals 5-6, valvate. Stamens in male flowers as many as the petals; filaments slender; anthers introrse; in female flowers reduced to staminodes. Ovary 5-6-celled in female flowers, rudimentary in male; style 0; stigma capitate. Fruit 4—6-celled, fleshy.

Toddalia aculeata, *Pers.* Vern. *Chingatti*, RK.—An evergreen climber with rambling stems up to 50 feet high and 4 inches diameter. Bark pale brown, fairly smooth, with numerous conspicuous paler circular lenticels and armed with small hooked prickles about 1 inch long, raised on old stems on the top of a conical woody pedestal up to 5 inch high. Blaze 1—3 inch, crisp, pale yellow closely mottled with sclerotic orange portions in the outer half, turning pinkish-brown on exposure. Leaves alternate, digitately trifoliolate. Petiole 6—1·2 inches long. Leaflets sessile, 2—4 by 7—1·5 inches, obovate-oblong or oblong, crenulate, shortly blunt-acuminate, base acute, glabrous, coriaceous, dark shining green above with many slender parallel nerves inconspicuous beneath. Flowers 15—25 inch diameter, pale greenish-yellow, in axillary and terminal pubescent panicles 1—2·5 inches long. Fruit 3—5 inch diameter, sub-globose, with 5 shallow grooves, yellowish. Seeds several, surrounded by a colourless mucilage.

Occurs throughout the area between 1,000 and 4,500 feet, usually in moist ravines or in swampy localities. Flowers: February—April. Fruit: July—September.

4. ZANTHOXYLUM, *Linn.*

Trees or erect or climbing shrubs, often armed with stout prickles. Leaves alternate, trifoliolate or imparipinnate; leaflets opposite or alternate, entire or crenate, often oblique, pellucid-punctate. Flowers small, in cymes, often unisexual. Calyx 3—8 fid, rarely 0. Petals 3—5, sometimes 0. Disk small or obscure. Stamens 3—5, hypogynous, reduced to scales in male flowers. Ovary of 1—5 carpels, rudimentary

in the male; styles free or connate above; stigmas capitate; ovules 2 in each cell. Fruit of 1—5 carpels, dehiscent ventrally.

I.—Petiole winged. Flowers apetalous.

- | | |
|---|-------------------------------|
| 1. Leaves glabrous. Flowers yellow | ... 1. <i>alatum</i> . |
| 2. Leaves pubescent. Flowers purplish-red | ... 2. <i>acanthopodium</i> . |

II.—Petiole not winged. Flowers polypetalous ... 3. *oxyphyllum*.

1. *Zanthoxylum alatum*, *Roxb.* Vern. *Timru* or *Timūr*, Gen.—An evergreen or subdeciduous shrub or occasionally a small tree up to 20 feet high and stem 9 inches diameter. Young shoots glabrous. Branches armed with nearly straight prickles up to .5 inch long, raised on old stems on the top of an oval woody pedestal. Twigs smooth, greenish, with scattered pale lenticels. Bark pale brown, rather deeply furrowed, corky. Blaze .3—.6 inch, pale yellowish-brown with or without paler streaks, soft, the whole rapidly darkening on exposure. Leaves imparipinnate, 4—9 inches long, the rachis with a foliaceous green wing up to .15 inch broad, often bearing straight pink prickles up to .6 inch long. Leaflets 5—11, lanceolate, more or less serrate and each serrature with a pellucid gland, sparsely pellucid-punctate, acute or acuminate, sessile, glabrous, dark glossy green above, pale beneath; the terminal 2.5—4.5 by .6—1.1 inches; the lateral smaller. Flowers polygamous, yellow, in dense pubescent lateral panicles 1—3 inches long. Fruit of 1—3 carpels. Carpels .15 inch diameter, globose, red, glabrous. Seed solitary, .1 inch diameter, globose, shining, black.

Occurs throughout the area between 3,000 and 7,000 feet. Common on open grazing lands and in secondary scrub forest. Flowers: April—June. Fruit: August—October.

2. *Zanthoxylum acanthopodium*, *DC.*—An erect shrub 4—10 feet high with stem up to 3 inches diameter. Young shoots glabrous or shortly pubescent. Stems and branches armed with broad-based straight prickles up to .6 inch long, raised on old stems on the top of an oblong woody pedestal. Bark greenish-ashy, smooth, with numerous pale circular raised lenticels. Blaze .1 inch, greenish. The whole plant very aromatic. Prickles, young shoots, and rachis and midrib of leaflets usually tinged pink or with pink glandular spots when young. Leaves imparipinnate, 4.5—10 inches long, the rachis with a foliaceous green wing up to .2 inch broad, the rachis and midrib usually armed with straight prickles up to .5 inch long. Leaflets 5—13, subequal, 1.5—3 inches long, oblong-lanceolate or the basal pair often ovate, acute, serrate with a gland at the base of each tooth, gland-dotted, shortly pubescent on both surfaces, main lateral nerves distinct 10—20 pairs, sessile. Flowers .15—.2 inch diameter, dull purplish-red, in axillary rounded panicles up to .5 inch long, usually 2 together in each leaf-axil.

Stamens twice the length of the sepals. Anthers yellow. Fruit of 1—4 carpels. Carpels .15 inch diameter, globose, slightly hairy. Seed solitary, .1 inch diameter, globose, shining, black.

Occurs at Naini Tal between 5,000 and 7,500 feet and is apparently also found in parts of the Almora District. It is found both in oak forest and on open sunny aspects, and is not uncommon round Naini Tal. Flowers: September. Fruit: August-September. In the absence of flowers or fruit this species may be distinguished from *Z. alatum* not only by the pubescent leaflets but also by the leaflets being dull instead of glossy above and by the glands not appearing as raised spots on the upper leaf-surface as is the case in *Z. alatum*.

3. *Zanthoxylum oxyphyllum*, Edgew.—An evergreen shrub with sarmentose weak rambling stems usually supported by the surrounding trees and shrubs and reaching 15 feet high and 2 inches diameter. Young shoots glabrous. Stems and branches armed with straight or hooked prickles up to .7 inch long, raised on old stems on the top of an oblong woody pedestal. Twigs smooth, green, not lenticellate. Bark greenish-brown, smooth, with conspicuous pale circular lenticels arranged in longitudinal lines. Blaze .1 inch, greenish. Leaves imparipinnate, 7—16 inches long, rachis not winged but profusely armed with purplish prickles above and below, the upper ones straight or sometimes absent the lower usually recurved. Leaflets 11—27, subequal, 1.25—3.5 by .6—1.5 inches, ovate to oblong-ovate, acuminate, base rounded, glandular-serrulate, gland-dotted beneath, the lower pairs usually alternate the upper opposite, glabrous. Petiolules .05—1.5 inch long, puberulous. Flowers .2 inch diameter, dark purplish-red, in terminal pubescent panicles 1—3 inches long, usually with a few prickles on the rachis. Anthers bright yellow. Fruit of 1—5 carpels. Carpels .2-.3 inch diameter, globose, dull red, glabrous. Seed solitary, .2 inch diameter, shining, black.

Occurs throughout the hills between 6,000 and 9,000 feet. Usually found in shady forest of *Quercus dilatata* on north aspects. Local, but often fairly common where it occurs. Flowers: May. Fruit: November-December.

5. LIMONIA, Linn.

Shrubs or small trees, often armed with spines. Leaves alternate, 3-foliolate or imparipinnate with usually opposite leaflets; petiole and rachis winged. Calyx 4-5-lobed or partite. Petals 4-5, imbricate. Stamens 8—10, free. Ovary 4-5-celled; style short, stigma obtuse or capitate; ovules 1-2 in each cell. Fruit a 1—4-celled and -seeded berry. Seeds imbedded in mucilage.

***Limonia acidissima*, Linn.** Vern. *Kath-bel*, SG.—A shrub or small tree up to 1.5 feet girth and 25 feet high, armed with sharp rigid straight thorns .5—1 inch long. Shoots pubescent. Bark yellowish-brown, rough, often with long vertical cracks, corky. Leaves

pinnate, 3—6 inches long; petiole and rachis jointed, the former narrowly, the latter very broadly winged. Leaflets 5—7, the lateral opposite, 1—2 inches long, sessile, rhomboid-ovate to lanceolate, usually obtuse and notched at the tip, base cuneate, margin crenulate, glabrous, gland-dotted. Flowers tetramerous, 3 inch diameter, white or pale yellow, fragrant, in short close axillary racemes 5—1 inch long often with 1-2 leaves at the base. Peduncles solitary or 2-3 together. Pedicels 2-3 inch long. Berry 3-5 inch diameter, globose, black when ripe. Seeds 1-4 imbedded in very bitter pulp.

Occurs in the Bhabar and outer hills up to 3,000 feet, but has not yet been recorded east of the Kosi river. Not common. It is usually found in dry miscellaneous forest. Flowers: April-May. Fruit: November-December.

6. SKIMMIA, *Thunb.*

Unarmed shrubs, strongly scented. Leaves alternate, simple, entire. Flowers polygamous, crowded in terminal panicles. Calyx, 4-5-lobed, imbricate. Petals 4-5, valvate or slightly imbricate. Disk obsolete. Stamens 4-5, imperfect in the female flower. Ovary entire, 2-5-celled; style single or 0; stigma capitate, 2-5-lobed; ovules solitary. Fruit a fleshy drupe with 2-5 cartilaginous 1-seeded stones.

Skimmia Laureola, *Sieb. and Zucc.* Vern. *Nair*, NG. *Naifa*, RK.—An erect evergreen glabrous shrub 2—4 feet high with stems up to 1 inch diameter. Bark fairly smooth. Blaze yellow. All parts strongly aromatic. Leaves crowded towards the ends of the branches, 3-6 by 1-1.5 inches, closely gland-dotted, oblong-lanceolate or oblanceolate, acute or acuminate, thick, softly coriaceous, lateral nerves obscure. Petiole 1-3 inch long, stout, flattened above. Flowers 3-5 inch diameter, pale greenish-yellow, fragrant, in compact, erect, terminal panicles 1.5-2 inches long. Stamens yellow, as long as the petals. Drupe ovoid, 5-7 inch long, red when ripe.

Occurs throughout the hills between 7,000 and 10,500 feet. Common in shady forest especially on north aspects, sometimes at the uppermost forest limit. Usually gregarious forming rather dense patches. Flowers: April-May. Fruit: October.

7. GLYCOSMIS, *Correa.*

Unarmed shrubs or small trees. Leaves 1-foliolate or imparipinnate; leaflets alternate. Flowers small, in panicles. Calyx 4-5-lobed; lobes broad, imbricate. Petals 4-5, imbricate. Stamens 8-10, free, inserted round a disk. Ovary 2-5-celled; style short; stigma capitate; ovules 1 in each cell. Fruit a dry or pulpy berry, 1-3-seeded.

Glycosmis pentaphylla, *Correa.* Vern. *Ban-nimbu*, R.—An evergreen shrub 4-10 feet high with stems up to 5 inches diameter. Twigs stout, smooth, glabrous, green. Bark fairly smooth. Blaze 2-4 inch,

rather fibrous, pinkish or purplish-brown. Leaves alternate or subopposite, 1—7-foliolate; rachis smooth, terete, up to 6 inches long. Leaflets opposite or alternate, variable in size and shape; the terminal usually much the larger and measuring 4—10 by 1·75—3·25 inches; all oblong or elliptic-oblong, apex variable, undulate, entire or remotely crenulate, base acute, gland-dotted, rather coriaceous, glabrous, aromatic when crushed, with about 9—12 pairs of lateral nerves. Petiolule ·05—·2 inch and rarely up to ·5 inch long. Flowers 1·2 inch diameter, whitish or yellowish, in pubescent or puberulous axillary and terminal panicles 1·5—4 inches long. Berry ·3—·5 inch diameter, depressed globose, dirty yellowish or pinkish. Seed 1.

Occurs in the subhimalayan tract up to 2,000 feet. Abundant both in *sal* and moist miscellaneous forests where it often forms dense undergrowth. Very gregarious. Flowers and fruit during most months of the year.

8. *CLAUSENA*, *Burm.*

Unarmed shrubs or trees. Leaves imparipinnate; leaflets alternate, gland-dotted. Flowers small. Calyx 4-5-lobed. Petals 4-5, free, imbricate. Stamens 8—10, inserted round the disk, alternately longer and shorter. Ovary usually 4-5-celled; style thick; ovules 2 in each cell. Fruit a 2—5-celled berry.

***Clausena pentaphylla*, DC.**—An erect shrub 3—6 feet high. Twigs tomentose, terete. Leaves alternate, 3—7-foliolate; the rachis terete, tomentose, stout, up to 7 inches long. Leaflets alternate or subopposite, 3—7 by 1·5—3·5 inches, elliptic rhomboid or ovate, acuminate or acute, base cuneate usually acute and oblique, entire rarely obscurely toothed, pubescent on both surfaces especially along the nerves, glandular especially on the leaf margin, pellucid-punctate, thinly coriaceous, aromatic when crushed, with about 7-12 pairs of lateral nerves. Petiolule ·05—·2 inch long. Flowers ·2 inch diameter, yellowish, tetramerous, in terminal softly pubescent panicles 4—12 inches long. Berry ·4—·7 inch long, ovoid, pale orange, verrucose with tufts of short hair or glabrescent when ripe.

Occurs in the subhimalayan tract up to 2,000 feet. Flowers: April—June. Fruit: July—September.

9. *MURRAYA*, *Linn.*

Shrubs or small trees, unarmed. Leaves pinnate; leaflets alternate. Flowers in corymbs or cymes, rarely solitary. Calyx 5-lobed.

Petals 5, free, imbricate. Stamens 10, inserted outside the disk; filaments alternately shorter and longer. Ovary 2—5-celled; style deciduous; stigma capitate; ovules solitary or 2 superposed in each cell. Fruit a 1-2-celled berry.

Leaflets 3—9. Flowers few	...	...	1. <i>exotica</i> .
Leaflets 9—25. Flowers numerous	...	...	2. <i>Koenigii</i> .

1. *Murraya exotica*, Linn. Vern. *Marchūla*, Gen. *Marchia*, BD.—An evergreen shrub or small tree up to 3 feet girth and 15 feet high, with dense spreading crown. Stem crooked and becoming fluted at the base with increasing age. Bark rough, pale yellowish-brown, rather corky. Blaze 1 inch, pale yellow, scarcely fibrous. Young parts pubescent. Leaves 4—7 inches long. Petioles glabrous. Leaflets 3—9, alternate or subopposite, 5—3 inches long, the terminal the largest; all ovate-elliptic or rhomboid, usually acuminate, entire, glabrous, glossy dark green above, paler and glossy beneath, base acute and oblique. Petiolules 1—2 inch long. Flowers 7—14 inches diameter, white, very fragrant, in axillary or terminal corymbs up to 12 inches long or in few-flowered lax cymes. Berry 5—7 inch long, oblong or ovoid, narrowed at both ends, smooth, red when ripe, seated on the persistent calyx.

Occurs throughout the subhimalayan tract and in the central and outer ranges between 1,500 and 4,500 feet. Fairly common in shady forest especially along ravines. Flowers: March—July. Fruit: November—February.

2. *Murraya Koenigii*, Spreng. Vern. *Gandhēla*, Gen. *Gannia*, BD.—An evergreen shrub usually 5—15 feet high but reaching 20 feet with stem 8 inches diameter. Twigs pubescent. Bark of stems up to about 3 inches diameter smooth, dark purplish-brown or greenish-black with numerous minute pale lenticels often coalescing to form short longitudinal lines; on old stems rough, dark brown. Blaze 2—35 inch, not or scarcely fibrous, pale yellow. Leaves 5—14 inches long. Petioles pubescent. Leaflets 9—25, usually 1—25 by 5—1 inch but the lowest often much smaller and rounder, ovate rhomboid or lanceolate, acuminate with obtuse notched or acute tip, base oblique, irregularly crenate-dentate, glabrous or nearly so above, pubescent beneath, sprinkled with black dots. Petiolules 12 inch long. Flowers 45 inch diameter, white, sweet-scented, in much-branched terminal pubescent corymbs. Fruit 3—5 inch long, globose or ellipsoid, somewhat laterally compressed, pink with pellucid dots finally turning shining purplish-black. Seeds large, green, surrounded by a white juicy pulp.

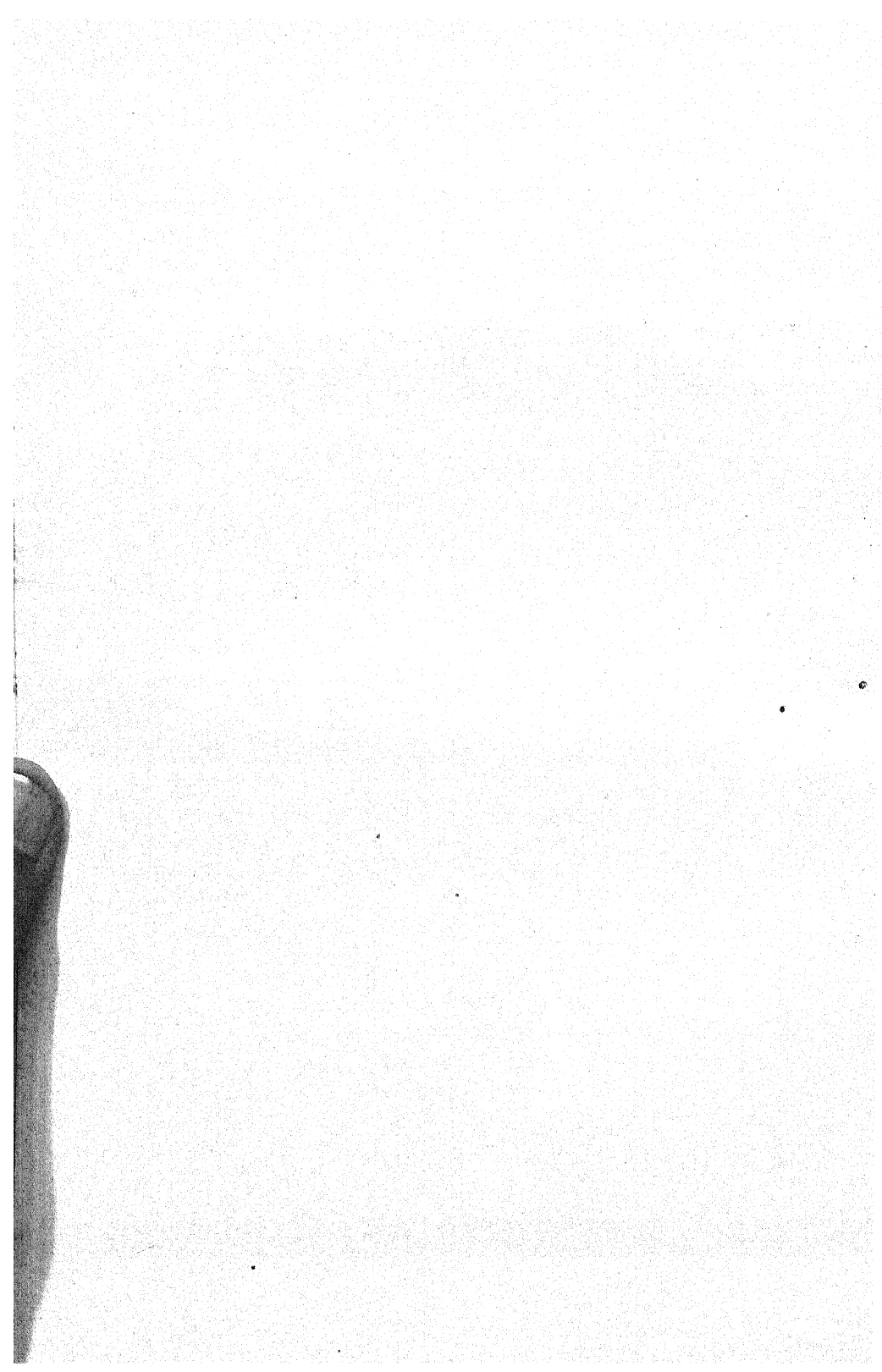
Occurs throughout the area up to 4,000 feet. Abundant in most types of forest and very gregarious in habit. Flowers: March—May. Fruit: June—July.

10. BOENNINGHAUSENIA, *Reichb.*

An undershrub. Leaves alternate. Flowers in compound terminal leafy paniced cymes. Calyx 4-lobed, persistent. Petals 4, oblong, imbricate. Stamens 6—8, alternately longer and shorter. Ovary long-stipitate, 3—5-lobed and -celled; styles 3—5, connate. Ovules 6—8 in each cell. Fruit of distinct carpels.

Boenninghausenia albiflora, *Reichenb.*—An erect deciduous or subdeciduous undershrub 1—3 feet high with stems up to .25 inch diameter, the basal half usually persistent and more or less woody. Bark smooth, peeling off in thin papery strips. Leaves 2—7 inches long, 2-and 3-pinnate. Leaflets variable in size up to .8 inch long, elliptic rhomboid or obovate, entire, tip emarginate or rounded, membranous, glabrous, pale glaucous green above, strongly aromatic when crushed. Petiolules 0—.1 inch long. Flowers .15—.25 inch long, in terminal spreading leafy panicles usually 6—12 inches long. Petals white, each with about two small yellow spots inside. Stamens about twice as long as the corolla. Carpels 3—5, .1 inch long or less, dark brown, deeply ribbed.

Occurs throughout the hills between 4,000 and 7,500 feet. Common and often gregarious in shady oak forest. Flowers: July—October. Fruit: November.



XIX.—SIMARUBACEÆ.

Trees or shrubs, usually with bitter bark. Leaves alternate, pinnate or rarely simple; stipules 0 or deciduous. Flowers regular, small, 1-sexual or polygamous rarely hermaphrodite. Calyx 3—5-lobed. Petals 3—5, rarely 0, valvate or imbricate. Disk usually present. Stamens as many as or twice as many as the petals, rarely indefinite, inserted at the base of the disk; filaments free; anthers usually introrse, dehiscing longitudinally. Ovary free, 1—6-celled; styles 2—5, free or united; ovules usually 1 in each cell. Fruit usually of 2—6 distinct carpels, sometimes samaroid or baccate. Seeds usually solitary.

PICRASMA, *Blume*.

Trees or shrubs. Leaves imparipinnate. Flowers dioecious or polygamous, in axillary panicles. Calyx minute, 4-5-toothed. Petals 4-5, often enlarging after flowering, valvate. Stamens in males as many as the petals, inserted round the thick disk, in females often wanting. Ovary of 3—5 distinct lobes each with a solitary ovule. Fruit of 1—5 fleshy or membranous drupes.

Picrasma quassioides, *Bennett*. Vern. *Karwi*, NG.—A large deciduous shrub or small tree up to 4 feet girth and 40 feet high. Young shoots, petioles and the rachis of young leaves rather densely clothed with rusty pubescence. Twigs and branches smooth, grey, with numerous small circular lenticels. Bark dark brown, roughish. Blaze .25—.5 inch, white or yellowish. Leaves and bark bitter. Leaves 9—18 inches long, pubescent. Leaflets 7—15, increasing in size from the base, the lateral opposite, the terminal 3.5—7 by 1.25—2.5 inches; all ovate to lanceolate, long-acuminate, serrate, membranous, nearly glabrous when mature. Petiolules of the lateral leaflets 0—.1 inch long, of the terminal leaflet .5—1.25 inches long. Flowers .25—.3 inch diameter, green, in axillary corymbose pubescent panicles 3—6 inches long. Fruit of 3—5 rather membranous drupes .2-.3 inch diameter, black when ripe, each containing one seed.

Occurs on the slopes of the main Himalayan range in North Garhwal between 6,000 and 8,000 feet, but has not yet been recorded from Almora. Fairly common in shady forest. The leaves turn yellow before falling. Flowers: May-June.



XX.—OCHNACEÆ.

Trees or shrubs. Leaves alternate, glabrous, simple or rarely pinnate, stipulate. Flowers regular, hermaphrodite, conspicuous, in racemes panicles or umbels rarely solitary. Sepals 4-5, free, imbricate, persistent. Petals 5, rarely 4-10, free, imbricate. Disk usually thick and enlarged in fruit. Stamens definite or indefinite, inserted at the base of the disk. Ovary 1-10-celled; styles simple; ovules 1-2 in each cell or indefinite. Fruit indehiscent, of several 1-4-seeded drupes or pyrenes, or capsular.

OCHNA, *Linn.*

Trees or shrubs. Leaves simple, usually serrate or crenate. Flowers in racemes panicles or umbels, conspicuous, yellow, from the ends of short woody branches. Sepals 5, imbricate, persistent, coloured. Petals 5-10, imbricate. Stamens numerous, shorter than the petals. Ovary deeply 3-10-lobed; lobes 1-celled; ovule 1 in each cell. Fruit of 3-10 distinct drupes seated on the enlarged disk.

***Ochna pumila*, Ham.**—A glabrous undershrub with a woody root-stock sending up annual, erect, scarcely woody shoots 6-18 inches high. Leaves 3-6 by 1-2.5 inches, broadly oblanceolate, apex rounded or acute, base gradually narrowed, finely and sharply serrate with apiculate ascending teeth, midrib prominent beneath. Petiole .1-.2 inch long. Stipules .3-.6 inch long, linear-lanceolate. Flowers 1.5-2 inches diameter, in pedunculate few-flowered axillary umbels 1.5-4.5 inches long. Peduncle 1-3 inches long. Pedicels .5-1.5 inches long. Drupes usually 4-6, .3-.4 inch long, oblong, greenish.

Has been collected in the Jaspur Range of the Ramnagar Division. It is usually found in open grassy *sal* forests and on waste lands. Flowers; April-June.



XXI.—BURSERACEÆ.

Trees or shrubs secreting oleo-resins in the cortex. Leaves alternate, rarely opposite, imparipinnate, 3-foliolate or rarely 1-foliolate, exstipulate or rarely stipulate. Flowers regular, hermaphrodite or polygamous, usually small, in racemes or panicles. Calyx 3—6-lobed, imbricate or valvate. Petals 3—6, free or rarely connate, imbricate or valvate. Disk free or adnate to the calyx-tube. Stamens as many as or twice as many as the petals, inserted below or on the disk; filaments usually free. Ovary free, usually 2—5-celled; ovules 2, rarely 1 in each cell. Fruit drupaceous, indehiscent with 2—5 pyrenes, rarely dehiscent and pseudocapsular.

GARUGA, *Roxb.*

Large trees. Leaves imparipinnate, crowded at the ends of the branches; leaflets opposite; stipules 0. Flowers polygamous, in much-branched panicles. Calyx campanulate, 5-lobed, valvate. Petals 5, inserted on the tube of the calyx, outside the disk. Stamens 10, inserted with the petals. Ovary 4-5-celled; ovules 2 in each cell. Fruit a fleshy drupe with 1—5 bony pyrenes, each 1-seeded.

***Garuga pinnata*, Roxb.** Vern. *Titmer*, EA and R.—A small or medium-sized deciduous tree up to 7 feet girth and 60 feet high. Bark roughish, dark brown sometimes almost silvery at others blackish in parts, exfoliating in irregular woody scales. Blaze .5—1 inch, soft, not or very shortly fibrous, without distinct fibrous bands, pink to reddish-brown. Young shoots pubescent. Leaves alternate. 6—18 inches long. Leaflets 11—21, up to 4 by 1.5 inches, ovate or oblong-lanceolate, crenate, long-acuminate, oblique, more or less pubescent on both surfaces even when mature. Petiolules .1—2 inch long. Flowers .25 inch long, yellow, in axillary tomentose panicles 6—12 inches long, appearing with or before the leaves, crowded towards the ends of the shoots. Drupe .7—1.2 inches diameter, globose, smooth, greenish-yellow; containing 1—4 pyrenes.

Occurs throughout the area up to 3,500 feet. Fairly common in dry miscellaneous forest. Flowers: March-April. Fruit: September-October.



XXII.—MELIACEÆ.

Trees or shrubs. Leaves alternate; usually pinnate rarely simple or bipinnate; stipules 0. Flowers regular, hermaphrodite or polygamodioecious. in panicles. Calyx usually small, 3—6-lobed, rarely entire or with free sepals, usually imbricate. Petals 3—6, free or rarely connate at the base. Disk tubular or annular, rarely obsolete. Stamens 4—12; filaments connate in a tube, rarely free. Ovary usually free, 2—8-celled; style simple; ovules 2, rarely more or solitary. Fruit various. Seeds sometimes arillate or winged.

I.—Leaves 1-pinnate.

A. Seeds winged. Stamens not united into a tube 1. *Cedrela*.

B. Seeds not winged. Stamens united into a tube

1. Fruit a drupe ... 2. *Azadirachta*.

2. Fruit a capsule, .5 inch diameter ... 3. *Heynea*.

3. Fruit a capsule, 1.5—2 inches diameter ... 4. *Dysoxylum*.

II.—Leaves 2- or 3-pinnate. Seeds not winged.

Stamens united into a tube ... 5. *Melia*.

1. CEDRELA, Linn.

Tall trees. Leaves imparipinnate. Flowers hermaphrodite, small, white, in terminal or subterminal panicles. Calyx short, 5-lobed. Petals 5, free, imbricate. Stamens 4—6, free, inserted on a raised disk, sometimes with alternating staminodes. Ovary 5-celled; style slender; ovules 8—12 in each cell, biseriate. Fruit a coriaceous 5-valved capsule. Seeds winged at one or both ends.

Leaflets entire. Seeds winged at both ends ... 1. *Toona*.

Leaflets serrate. Seeds winged only at the apex ... 2. *serrata*.

1. *Cedrela Toona*, Roxb. Vern. *Tun*, Gen. *Suni*, RK. Eng.

Toon.—A large deciduous tree commonly up to 9 feet girth and 90 feet high. Bark dark grey or reddish-brown, rough with shallow reticulate cracks exfoliating in irregular woody scales. Blaze .5-.6 inch, fibrous throughout, pink or pinkish-brown sometimes with a few white bands towards the outside, bitter to the taste, juice turning purple on the blade of a knife. Leaves 12—24 inches long, usually glabrous when mature or with tufts of hair in the nerve-axils beneath, often paripinnate by the abortion of the terminal leaflet. Leaflets 10—30, opposite or alternate, 2—6 by .7—2.5 inches, lanceolate or ovate-lanceolate, acuminate, entire or faintly sinuate, base oblique. Petiolules .2—.5 inch long. Flowers

·15—·2 inch long, cream-coloured, scented, in drooping or suberect terminal panicles 6—16 inches long, the pedicels not reflexed in fruit. Capsule ·7—1 inch long, oblong. Seeds winged at both ends.

Occurs throughout the area up to 4,500 feet. Common in low-lying depressions and on the banks of streams. Frequently planted. Flowers: March-April. Fruit: June-July.

2. *Cedrela serrata*, Royle. Vern. *Dalla* or *Dal*, Gen. Eng. Hill Toon.—A small or large deciduous tree attaining 11 feet girth and 100 feet high. Bark dark brown, rough, with regular and fairly deep vertical fissures about 1 inch apart. Blaze 1 inch, fibrous throughout, pink or red. Twigs stout, the leaves approximate towards the ends of the branches, leaving large and prominent heartshaped leaf-scars. Leaves 2-3 feet long, or up to 4·5 feet on young trees, usually imparipinnate, the midrib usually reddish at least when young. Leaflets 13—33, opposite, 3—6 by 1-2 inches, elliptic-oblong or oblong-lanceolate, acutely acuminate, serrate, base oblique, glabrous or pubescent on the nerves beneath when young, emitting a foetid smell when bruised. Petiolules ·1—·5 inch long. Flowers ·15—·2 inch long, foetid, pinkish, in large drooping subterminal panicles 2—4 feet long, the pedicels reflexed in fruit. Capsule 1—1·5 inches long, ovoid, reddish-brown. Seeds winged at the upper end only.

Occurs throughout the hills between 4,000 and 7,500 feet. Scarce along the outer ranges, fairly common in the interior especially in secondary forest on north aspects and in ravines. Flowers: May-June. Fruit: October.

2. AZADIRACHTA, A. Juss.

A tree. Leaves alternate, imparipinnate. Flowers hermaphrodite, in axillary panicles. Calyx 5-lobed. Petals 5 much exceeding the calyx, free, imbricate. Disk 0. Staminal tube 9-10-lobed at the apex; anthers opposite the lobes. Ovary 3-celled; style elongate; stigma 3-lobed; ovules 2 in each cell. Fruit a 1-seeded drupe; endocarp woody.

Azadirachta indica, A. Juss. Vern. *Nim*, Gen.—A medium-sized glabrous evergreen tree. Leaves 8—15 inches long, crowded towards the ends of the branches. Leaflets 9—17, 1—3 by ·5—·1 inch, sub-opposite, obliquely lanceolate or falcate, acuminate, coarsely serrate, often somewhat lobed near the obtuse base, bright green and shining above, paler beneath. Petiolules up to ·1 inch long. Flowers ·3 inch diameter, white, scented, in branched glabrous panicles 3—7 inches long. Staminal tube ·2 inch long, glabrous, a little shorter than the petals. Drupe ·5—·7 inch long, ellipsoid, greenish-yellow when ripe.

Occurs in the subhimalayan tract where it is frequently planted round villages or as a roadside tree. It appears also to be self-sown, at least in adjoining tracts if not within our area itself, though there is I think no evidence to show that it is truly indigenous. Flowers: March-April. Fruit: July.

3. HEYNEA, Roxb.

Trees or rarely shrubs. Leaves imparipinnate; leaflets 5—11, opposite. Flowers small, hermaphrodite, in panicles. Calyx 4-5-lobed. Petals 4-5, free, subimbricate. Stamens 8—10, the tube cleft into as many 2-toothed segments; anthers attached between the teeth. Disk annular. Ovary sunk in the fleshy disk, 2-3-celled; ovules 2 in each cell. Fruit a 1-celled, 2-valved capsule. Seeds arillate.

Heynea trijuga, Roxb. Vern. *Ban-ritha*, H and EA.—A small evergreen tree. Bark grey or brown with shallow cracks. Blaze .25 inch, deep reddish-brown to crimson. Twigs pubescent, lenticellate. Leaves 12—18 inches long. Leaflets 5—9, 3—6 by 1.5—2.5 inches, oblong or ovate, acuminate, base rounded, entire, glabrous, pale and glaucous beneath, with about 10—15 pairs of lateral nerves. Petiolule .2—8 inch long. Flowers .15—2 inch diameter, white, in lax, terminal and axillary, corymbose, pedunculate panicles 6—12 inches long. Peduncles 4—9 inches long, slender; the peduncle and branches minutely pubescent. Capsule .5—6 inch diameter, globose, reddish. Seeds 1 (rarely 2) black, surrounded by a thin white aril.

Occurs in the Bhabar and outer hill ranges east of the Gaula river between 1,000 and 5,000 feet elevation. Flowers: April-May. Fruit: November-January.

4. DYSOXYLUM, Blume.

Trees. Leaves large, usually alternate, imparipinnate or abruptly pinnate; stipules 0. Flowers hermaphrodite. Calyx subentire or 4-5-lobed. Petals 4-5, valvate or slightly imbricate. Staminal tube cylindrical, dentate or crenulate; anthers 8—10, included or half exserted. Disk tubular or cup-shaped. Ovary free, 2—5-celled, attenuated into a long style; ovules 1-2 in each cell. Fruit a 1—4-celled loculicidal capsule; valves coriaceous. Seeds sometimes arillate.

Dysoxylum binectariferum, Hook f. Syn. *D. macrocarpum*, Bedd.—A small or medium-sized tree up to 5 feet girth and 50 feet high. Bark pale brown or ashy, fairly smooth or roughish with an exterior corky layer. Blaze .3—6 inch, rather hard, not fibrous, pale orange with or without darker streaks. Twigs stout, smooth, clothed with a thick pale scurfy crustation. Leaves alternate, 12-24 inches long, imparipinnate. Petiole and rachis glabrous. Leaflets 6—11, alternate, 4—9 by 1.5—3.5 inches, elliptic-oblong or oblong, the lower leaflets broader and often much smaller, entire or sinuate, acuminate, base rounded or cuneate and often very oblique, glabrous, dark glossy green, midrib prominent beneath; lateral nerves 7—12 pairs, arcuate, not reticulate between. Petiolule .2-3 inch long. Flowers .3-4 inch

diameter, in terminal minutely pubescent panicles 2—4 inches long. Calyx shortly 4-lobed or -toothed, about half the length of the petals. Ovary 4-celled. Capsule 1·5—2 inches diameter, orange suffused with reddish, smooth, globose or pyriform, 8-grooved (4 less distinct) narrowed at the base. Seeds 1—3, large, black, enclosed in a scarlet aril.

This species has only been collected from the east of the Haldwani Division near Pilapani where it is found growing with *jamun* in a moist situation between 600 and 700 feet elevation. Flowers: September. Fruit: January.

5. MELIA, *Linn.*

Trees or shrubs. Leaves alternate, 2-3-pinnate. Flowers hermaphrodite in large axillary panicles. Calyx 5-lobed, imbricate. Petals 5, free, exceeding the calyx. Disk annular. Staminal tube slightly dilated and lacinate at the mouth; anthers 10, included. Ovary 5—8-celled; style elongate; stigma capitate. Fruit a fleshy drupe with hard woody endocarp; cells 1-seeded.

Melia Azedarach, *Linn.* Vern. *Dainkan*, Gen. *Denkna*, NG. *Betūn*, R. *Betain*, EA. Eng. Persian Lilac.—A medium-sized deciduous tree up to 5 feet girth and 45 feet high. Bark dark grey or blackish with shallow somewhat reticulate fissures, but smooth on young stems. Blaze 3—5 inch, coarsely fibrous, pale yellowish with darker parallel lines. Young shoots clothed at first with stellate hairs but rapidly becoming glabrous. Leaves bi-occasionally tri-pinnate, 12—24 inches long. Pinnae 3-4 pairs, more or less opposite, up to 12 inches long. Leaflets 3—11, opposite or nearly so, 5—2 by 3—1 inch, ovate or lanceolate, glabrous or nearly so, base often oblique, acuminate, serrate or gashed, sometimes lobed. Petiolules 0—3 inch long, that of the terminal leaflet sometimes longer. Flowers 25—3 inch long, fragrant, in long-peduncled panicles 3—9 inches long, puberulous at first. Petals lilac. Staminal tube 2·3 inch long, purple. Drupe 5·6 inch long, globose or ellipsoid, 5-6-celled, yellow and plump when ripe becoming wrinkled and remaining on the tree long after ripening.

Occurs throughout the area up to 4,000 feet. It is commonly planted round villages and along roads and is frequently found self-sown. I see however no reason to believe that the tree is indigenous in our area. Flowers: March—May. Fruit: November—February.

XXIII.—OLACACEÆ.

Trees or shrubs, sometimes straggling or climbing. Leaves usually alternate; stipules 0. Flowers small, hermaphrodite. Calyx small, sometimes accrescent. Petals 5-6, free or slightly connate at the base. Stamens as many as and opposite to or twice as many as the petals, sometimes with as many or twice as many staminodes alternate with them. Disk usually embracing the base of the ovary. Ovary free, 1—5-celled; style simple; ovules solitary or 2-3 in each cell. Fruit a 1-seeded drupe.

OLAX, *Linn.*

Trees or shrubs, often climbing, sometimes armed. Leaves alternate, simple. Flowers in axillary racemes or panicles, sometimes solitary. Calyx minute, enlarged in fruit. Petals hypogynous, valvate, free or more or less connate, usually 3. Stamens usually 3 fertile, with 6 bifid staminodes. Ovary free, more or less 3-celled; stigma 3-lobed; ovules 3. Fruit more or less enclosed in the accrescent calyx; stone crustaceous.

***Olax nana*, Wall.**—An undershrub with woody rootstock, sending up annual erect striate herbaceous shoots 1-2 feet high. Leaves 1-2·5 by ·3—·6 inch, subsessile, oblong-lanceolate or linear-oblong, entire, obtuse, glabrous, dark green above, glaucous beneath, margins recurved. Flowers white, ·25—·3 inch diameter, solitary, axillary. Peduncles ·25—·5 inch long, slender. Fruit an oblong or obovoid drupe, ·5 inch diameter including the accrescent fleshy scarlet calyx.

This species seems to occur in the subhimalayan tract, though there are no specimens from our area at Dehra Dun. At Kew however there is a sheet collected by Falkener labelled Garhwal, and other sheets from Hardwar and Pilibhit both just outside the area of this flora. It is a plant of dry grass lands. Flowers: April-May. Fruit: May-June.

Olax scandens, Roxb. is also found within our area according to Duthie, but as there seems to be some doubt about this I have not described it separately here. It is a large usually scandent shrub with orbicular to ovate leaves 1—3 inches long, pubescent beneath, and white flowers ·25—·3 inch long in short axillary racemes appearing from April to June. The fruit is a yellow fleshy drupe ·3 inch diameter ripening from October to December.



XXIV.—ILICACEÆ.

Trees or shrubs. Leaves alternate, simple, usually coriaceous and evergreen; stipules 0 or minute. Flowers regular, small, usually dioecious, in axillary cymes fascicles or umbels. Calyx 3—6-lobed. Petals 4-5, rarely more, connate at the base or free in the female, imbricate. Stamens isomerous with the petals and alternate with them, inserted on the base of the corolla. Disk 0. Ovary free, 3—6-celled rarely more; ovules 1 or 2 in each cell; style 0 or very short; stigma capitate or discoid. Fruit a drupe with 2 or more, 1-seeded, free or connate, stones.

ILEX, Linn.

Trees or shrubs. Calyx 4—6-lobed. Corolla rotate; petals 4—6, free or connate at the base. Stamens adhering to the base of the corolla in the male, imperfect and often hypogynous in the female. Ovary 2—12-celled. Stigmas free or confluent. Drupe with 2—12 stones; pericarp thick and bony.

A. Leaves usually spinous-toothed. Stones usually 2 ... 1. *diphyrena*.

B. Leaves serrate.

1. Stones usually 4. Fruit black when ripe ... 2. *odorata*.

2. Stones usually 5—7. Fruit red when ripe ... 3. *fragilis*.

C. Leaves entire. Stones usually 5 ... 4. *Doniana*.

1. *Ilex diphyrena*, Wall. Vern. *Kandāi*, G and RK. *Kandēla*. G. *Kandir*, G.—A small evergreen tree with stout horizontal branches forming a dense crown. Bark grey, fairly smooth, often with large horizontal wrinkles and sometimes with conspicuous vertical lines of lenticels. Blaze rather hard and crisp, pale yellow mottled with brown. Leaves 2—4 by 7—1.5 inches, ovate, elliptic-lanceolate or lanceolate, usually with strong spinous teeth, dull green above, paler beneath, mucronate, very coriaceous, glabrous, margins thickened and slightly recurved. Petiole .05—.2 inch long, stout, channelled. Flowers .3-.4 inch diameter, pale greenish or greenish-yellow, scented, usually 2-sexual, in axillary globose clusters. Pedicels very short, stout. Drupe .3 inch diameter, globose, scarlet, usually with 2 stones which are deeply grooved on the convex side.

Occurs throughout the hills between 5,000 and 10,500 feet. Common in shady oak forest. Flowers: April-May. Fruit: December—February.

2. *Ilex odorata*, Buch-Ham.—A small evergreen tree up to 4 feet girth and 40 feet high with a dense crown of dark foliage. Bark pale brown, slightly rough owing to the presence of raised circular lenticels. Blaze .35 inch, pale yellow mottled with pale orange. Twigs green. Leaves 4—8 by 1.5—2.5 inches, variable, from ovate to elliptic-lanceolate or elliptic-oblancheolate, acuminate, regularly and closely serrate; thinly coriaceous, glabrous. Petiole .3—8 inch long, stout, channelled above. Flowers .15—2 inch diameter, 1-sexual, white, both sexes in short axillary paniced cymes up to .8 inch long clustered several together in the leaf-axils. Pedicels slender. Drupe .2 inch diameter, globose, black, usually with 4 stones.

Occurs throughout the hills between 3,000 and 5,000 feet. Rather scarce. Generally found growing along the banks of streams. Flowers: April-May.

3. *Ilex fragilis*, Hook, f. Vern. *Kala-arua*, EA.—A small glabrous tree up to 4 feet girth. Bark on young stems smooth, grey, very lenticellate, becoming darker and rougher on old stems. Leaves 3.5—6 by 1.25—2 inches, elliptic or ovate, acuminate, serrulate, the teeth apiculate, membranous, with about 9 pairs of lateral nerves prominent beneath. Petiole .4—6 inch long, slender. Flowers .15 inch diameter, white, 1-sexual, the female in axillary fascicles of 2-3 on peduncles .1—1.5 inch long. Drupe .1—1.5 inch diameter, globose, red, containing 5—7 stones immersed in a viscous juice.

According to Mr. W. J. Lambert this species occurs between 7,500 and 8,500 feet in oak forest above Munsiri and at Bodgarhi in the Jhagula Gadh, both places in East Almora. Fruit: October.

4. *Ilex Doniana*, DC. Syn. *Ilex excelsa*, Wall. Vern. *Gaibsaiib*, RK. *Sain*, EA.—A small or medium-sized evergreen tree up to 7 feet girth and 50 feet high. Bark pale grey or ashy, smooth, with horizontal lines and wrinkles and occasional deep vertical fissures, covered with small circular lenticels. Blaze .5—7.5 inch, cheesy, not fibrous, pale yellow. Shoots up to one year old and petioles tinged purple, glabrous or pubescent. Leaves 2—4.5 by 1.25—1.75 inches, ovate or elliptic, acuminate, entire, rather thin, glabrous and rather glossy dark green above with paler venation, glabrous or pubescent beneath, lateral nerves arcuate 6-8 pairs. Petiole .3—7 inch long, slender, slightly channelled above, glabrous or pubescent. Flowers .15 inch diameter, greenish, 2-sexual, in axillary pubescent umbels. Peduncle .1—5 inch long, usually 5—15-flowered. Pedicels .1-2 inch long. Drupe .2 inch diameter, globose, bright red, with 4-5 trigonous stones.

Occurs throughout the hills between 3,500 and 6,000 feet. Fairly common along ravines in *chir* and *benj* forests. Flowers: May-June. Fruit: December-March.

XXV.—CELASTRACEÆ.

Trees or erect or climbing shrubs, sometimes thorny. Leaves opposite or alternate, simple; stipules caducous or 0. Flowers regular, hermaphrodite or polygamous, usually cymose. Calyx small, 4-5-lobed, persistent. Petals 4-5, inserted below the disk or on the margin, imbricate. Disk usually conspicuous, rarely 0. Stamens as many as the petals and alternate with them, inserted on or under the margin of the disk. Ovary on the disk or immersed in it, 2—5-celled; style short or 0; stigma simple or lobed; ovules 1-2 in each cell. Fruit capsular or drupaceous. Seed usually arillate.

I.—Fruit a capsule.

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|---|-----|-----|-----|-------------------------|
| A. Leaves opposite | ... | ... | ... | 1. <i>Euonymus</i> . |
| B. Leaves alternate. | | | | |
| 1. A climber, unarmed. Flowers racemose | ... | ... | ... | 2. <i>Celastrus</i> . |
| 2. Erect, armed. Flowers cymose | ... | ... | ... | 3. <i>Gymnosporia</i> . |

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|-------------------|-----|-----|-----|-------------------------|
| II.—Fruit a drupe | ... | ... | ... | 4. <i>Elæodendron</i> . |
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1. EUONYMUS, *Linn.*

Trees or shrubs, usually glabrous, sometimes climbing. Leaves opposite; stipules deciduous. Flowers hermaphrodite, in axillary 2—3-chotomous cymes. Calyx 4—5-lobed; lobes spreading or recurved. Petals 4-5, imbricate. Stamens inserted on the disk. Disk large, fleshy, 4-5-lobed. Ovary sunk in the disk, 3—5-celled; style short, thick; stigma 3—5-lobed; ovules 2 in each cell. Fruit a 3—5-celled loculicidal capsule, lobed angled or winged, sometimes echinate; cells 1-2-seeded. Seeds enclosed in a fleshy aril.

I.—Erect trees or shrubs. Capsules not echinate.

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|---|-----|-----|-----|---------------------------|
| A. Leaves evergreen, thick. | | | | |
| 1. Midrib and primary nerves prominent and pale above. Capsule winged | ... | ... | ... | 1. <i>pendulus</i> . |
| 2. All nerves much depressed above. Capsule lobed | ... | ... | ... | 2. <i>tingens</i> . |
| B. Leaves deciduous. | | | | |
| 1. Flowers 2—3 inch diameter. | | | | |
| (a) Capsule lobed, about 3 inch broad | ... | ... | ... | 3. <i>Hamiltonianus</i> . |
| (b) Capsule winged, about 1 inch across the wings | ... | ... | ... | 4. <i>lacerus</i> . |
| 2. Flowers 9—1 inch diameter | ... | ... | ... | 5. <i>grandiflorus</i> . |

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|---|-----|-----|-----|-----------------------|
| II.—A creeping or climbing shrub. Capsules echinate | ... | ... | ... | 6. <i>echinatus</i> . |
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1. *Euonymus pendulus*, Wall. Vern. *Chopri* or *Kath-konkon*, G. *Teli* or *Kanek*, RK.—A small or medium-sized evergreen tree up to 9 feet girth and 45 feet high. Twigs smooth, green, often pendulous. Bark pale ashy-brown or almost whitish, rough, corky, exfoliating in small irregular pieces. Blaze .35—.75 inch, soft, shortly fibrous, pink, the juice turning purple on the blade of a knife, outer dead tissue bright yellow. Leaves 3—5 by 1.1—1.5 inches, oblong-lanceolate or oblong, narrowed at both ends, sharply serrate, glabrous, dark glossy green above with prominent pale midrib and primary nerves, pale and somewhat glossy beneath, coriaceous. Petiole .3—.5 inch long, stout, channelled. Flowers .3—.5 inch diameter, greenish, 4-merous or sometimes 5-merous in 3—21-flowered dichotomous cymes which are more or less clustered at the tips or bases of the shoots. Peduncles 1—3 inches long, flattened, green. Pedicels .2—.3 inch long. Petals orbicular, white, fringed. Capsule .3 inch long, winged, .6 inch across the wings. Aril dark orange.

Occurs throughout the hills between 5,000 and 8,000 feet. Very common in dense forest and shady ravines. Young immature leaves are usually a bright glossy pink. Flowers: May-June. Fruit: November—February.

2. *Euonymus tingens*, Wall. Vern. *Konkon*, G.—A small evergreen tree with rather dense rounded crown up to 8 feet girth and 25 feet high. Twigs rough with minute tubercles, glabrous. Bark grey or pale ashy, roughish, corky. Blaze .35—.9 inch, shortly fibrous, pink or white with pink bands, often tinged with chlorophyll on the outside, dead tissue orange-yellow. Leaves 1.3—3 by .7—1.3 inches, elliptic or ovate-lanceolate, acute or acuminate, serrate or crenate, glabrous, thick, somewhat glossy dark green above with very depressed secondary and tertiary nerves. Petiole .2—.3 inch long. Flowers 5-merous or sometimes 4-merous, .5—.75 inch diameter, faintly scented, in axillary dichotomous cymes which are often clustered at the bases or tips of the shoots without subtending leaves. Peduncles .5—1.5 inches long, flattened. Pedicels .3—.5 inch long. Petals pale yellowish-white veined with purplish-red, orbicular. Capsule .5 inch long, turbinate, lobed or obscurely angled. Seeds dark brown, shining, half enclosed in a red aril.

Occurs throughout the area between 6,000 and 9,000 feet. Common in oak forest. Flowers: April—June. Fruit: November-December.

3. *Euonymus Hamiltonianus*, Wall.—A small deciduous tree. Twigs terete, green, smooth. Bark pale brown, rough, corky, rather deeply furrowed. Leaves variable, 2.5—5 by 1—3 inches, usually elliptic or oblong, sometimes broadly ovate-elliptic, membranous or somewhat coriaceous when mature, glabrous, dull green, finely and closely

serrate, the teeth with deciduous cuspidate tips. Petiole .3—·5 inch long. Flowers .3 inch diameter, greenish-white, 4-merous, in di- or tri-chotomous cymes which are axillary or in the axils of deciduous bracts and often crowded. Peduncle .3—1 inch long. Pedicels .1—·3 inch long. Petals oblong, entire. Capsule .3 inch long, turbinate, deeply lobed. Seeds brown, shining, enclosed in a scarlet aril.

Occurs throughout the hills between 3,000 and 8,000 feet. Rather scarce. Adventitious shoots sometimes develop four broad corky wings running down the stem. Flowers: March—June. Fruit: October–November.

4. *Euonymus lacerus*, Buch-Ham. Syn. *E. fimbriatus*, Wall. Vern. *Pinna*, NG. *Pini*, RK.—A large deciduous shrub or small tree up to 4 feet girth and 25 feet high. Twigs terete, slender, smooth, glabrous and green, but often pink when young. Bark fairly smooth, pale grey and sometimes silvery, lenticellate, exfoliating in small irregular woody scales. Blaze .25—·35 inch, white or pink with anastomosing white or pale yellow very fibrous bands. Leaves 2—5 by 1.2–5 inches, ovate elliptic or obovate, acuminate, thin, membranous, pale unglossed green above, rather glossy beneath, glabrous, sharply 1- or 2-serrate teeth prominent. Petiole .2—·5 inch long, the petiole and leaf-margins usually pinkish. Flowers .2—·25 inch diameter, 4-merous, greenish-white, in lax cymes, from 1—6 at the base of each shoot. Peduncles .5—2.5 inches long, very slender, subumbellately branched at the top. Pedicels .1—·2 inch long, filiform. Petals ovate, entire, white. Capsule .4 inch long, winged, 1 inch across the wings. Seeds grey, shining, enclosed in a scarlet aril.

Occurs throughout the central and inner ranges between 6,500 and 10,500 feet. Common and often associated with silver fir. Flowers: April–May. Fruit: October.

5. *Euonymus grandiflorus*, Wall.—A large deciduous shrub, occasionally almost a small tree, attaining 30 feet high with stem up to 10 inches diameter. Bark slightly rough, brown, with shallow fissures, old stems appearing ribbed due to regular shallow broad grooves. Blaze .25 inch, fibrous, white, sometimes bright orange-red or tinged with chlorophyl beneath the dead outer tissue. Twigs smooth, glabrous. Leaves 2.5—4.5 by 1.25—2.25 inches, obovate or elliptic, finely serrulate, base acute, not thick, dark glossy green with pale venation above, pale and somewhat glossy beneath, glabrous. Petiole .2—·4 inch long. Flowers .9—1 inch diameter, 4-merous, in solitary erect axillary glabrous cymes 1.5—3 inches long, 3—7-flowered. Peduncles green, flattened, 1.25—2.5 inches long. Pedicels .2—·5 inch long. Petals pale greenish-yellow, orbicular, not veined or streaked. Disk flat, bright green, .35—·4 inch diameter. Capsule .4 inch diameter, rather deeply 4-lobed,

not winged, pink when ripe. Seeds black, shining, half enclosed in a scarlet aril.

Occurs in the central hill ranges of Almora between 5,000 and 6,500 feet, but has not been recorded west of the Ramganga. Scarce though somewhat gregarious. In oak forest or sheltered hollows in *chir*. Flowers: May-June.

6. *Euonymus echinatus*, Wall.—An evergreen shrub creeping over rocks or climbing up the stems of trees by means of adventitious roots, in the latter case attaining 12 feet high; stems up to 1 inch diameter. Twigs green, deeply ribbed, quadrangular when young, glabrous. Leaves 1—2.5 by .5—1 inch, elliptic-lanceolate, serrulate, glabrous, rather thick, dark green above, paler beneath, glossy on both surfaces especially beneath, with 5—10 pairs of lateral nerves joined by intramarginal loops indistinct on the lower surface. Petiole .1—2 inch long, channelled. Flowers .25—.35 inch diameter, pale greenish-yellow or green, 4-merous, in axillary 1—7-flowered cymes. Peduncles .5—1 inch long, very slender. Pedicels .1—.3 inch long, filiform. Capsule .3 inch diameter, globose, covered with short conical tubercles. Seeds white (Parker says dark-brown) enclosed in a scarlet aril.

Occurs throughout the hills between 7,000 and 9,000 feet. Fairly common in shady forest. Flowers: April-May. Fruit: October-November.

2. CELASTRUS, *Linn.*

Climbing unarmed shrubs. Leaves alternate, entire or crenulate; stipules 0 or minute. Flowers polygamous. Calyx 5-lobed. Petals 5, spreading. Disk broad, 5-lobed. Stamens 5, inserted on the margin of the disk. Ovary in female flowers 3-celled; stigmas 3, recurved; ovules 2 in each cell. Fruit a 1—3-celled, loculicidal capsule, 1—6-seeded. Seeds enclosed in a fleshy aril.

***Celastrus paniculata*, Willd.** Vern. *Malkauni*, G. *Mālakōni* or *Mā'kāngni*, Gen. *Pāphakani*, FA.—A large deciduous climber with stems up to 9 inches diameter and 60 feet high sometimes twining dextrorsely but more often rambling. Twigs fairly smooth, reddish-brown, densely covered with small elongate whitish lenticels. Bark pale brown, rough with shallow cracks, exfoliating in small soft scales. Blaze .3—.4 inch, not fibrous, pink finely streaked with red or reddish-brown, the juice turning blue on the blade of a knife. Leaves 2.5—4 by 1.5—3 inches, broadly elliptic ovate or obovate, abruptly short-acuminate, crenate-serrate, rather coriaceous, glabrous, lateral nerves arching. Petiole .3—.6 inch long. Flowers .15 inch diameter, green, in terminal drooping panicles 2—8 inches long. Capsules .4—.5 inch diameter, depressed-

globose, 3-lobed, bright yellow, 3—6-seeded. Seeds completely enclosed in an orange-red aril.

Occurs throughout the area between 1,000 and 4,000 feet elevation. Fairly common in dry miscellaneous forest. Flowers: April-June. Fruit: November-March.

3. GYMNOSPORA, *W. and A.*

Shrubs or small trees, usually thorny. Leaves alternate, exstipulate. Flowers hermaphrodite, in axillary, solitary or fascicled, dichotomous cymes. Calyx 4—5-lobed. Petals 4—5, spreading. Disk lobed or sinuate. Stamens inserted below the disk. Ovary attached by a broad base to, or sunk in, the disk, 2—3-celled; stigmas 2—3; ovules 2 in each cell. Fruit a 2—3-celled capsule. Seeds 1—4, usually arillate.

I.—Leaves glabrous. Lateral nerves 4—8 pairs.

1. Leaves ovate, 1-2 inches long ... 1. *Royleana*.

2. Leaves narrowly lanceolate, 2—4 inches long... 2. *rufa*.

II.—Leaves pubescent. Lateral nerves 9—14 pairs ... 3. *Falconeri*.

1. *Gymnosporia Royleana*, *Wall.* Vern. *Kanai* or *Gwaldari*, RK.—An erect evergreen shrub 4—12 feet high with stems up to 8 inches diameter. Twigs glabrous or nearly so. Bark pale brown, roughish, corky. Blaze .25—.35 inch, cheesy, pink sometimes with purplish markings. Branches stiff usually armed with straight, sharp, axillary, simple thorns up to 1.2 inches long. Leaves .5—2.5 by .4—1.2 inches, ovate elliptic or obovate, thick, coriaceous, glabrous, serrulate, dull dark green, with 4—8 pairs of very indistinct lateral nerves. Petiole .1—.25 inch long, glabrous, often tinged pink. Flowers .2—.25 inch diameter, white or greenish-yellow, in fascicled axillary few-flowered cymes up to .4 inch long; rarely produced on the axillary thorns. Pedicels .1—.2 inch long, slender, often tinged pink. Capsule .3—.5 inch long, turbinate, 3-celled, slightly lobed, smooth, brown. Seeds 3—6, almost completely surrounded by a white aril.

Occurs throughout the hills between 3,000 and 6,500 feet. Fairly common in dry miscellaneous scrub forests. Flowers chiefly during February and March. Fruit: September-December.

2. *Gymnosporia rufa*, *Wall.* Vern. *Gwaldari*, EA.—A large evergreen glabrous shrub. Branches often armed with straight, sharp, slender, simple, axillary thorns .25—1 inch long. Leaves 1.5—4 by .5—1.2 inches, narrowly elliptic-lanceolate, tapering at both ends to an acute point, serrulate, sub-coriaceous, with 4—7 pairs of very fine secondary nerves. Petiole .1—.4 inch long. Flowers .05 inch diameter, in long-peduncled, often densely-fascicled, axillary cymes .5—1.5 inches long.

Peduncles and pedicels filiform. Capsule .2—·25 inch long, turbinate, 3-celled, slightly lobed, smooth, brown.

Occurs in Central and East Almora between 3,000 and 6,500 feet. Flowers: March. Fruit: July.

3. *Gymnosporia Falconeri*, Laws.—An erect evergreen shrub 4—12 feet high with stems up to 5 inches diameter. Twigs clothed with close short white pubescence, often pink when young. Bark fairly smooth, pale brown sometimes almost silvery with a thin somewhat mealy exterior. Blaze .1—·3 inch, cheesy, not fibrous, pink sometimes with a few narrow white bands. Branches often armed with straight, sharp, slender, simple, axillary thorns .25—1 inch long. Leaves 1.25—3.5 by .5—2 inches, elliptic or ovate with acute or rounded tip, serrulate, base cuneate or acute, clothed on both surfaces with short white pubescence which is denser beneath, dull green on both surfaces, with about 9—14 pairs of lateral nerves. Petiole .1—·3 inch long, pubescent, often pink when young. Flowers .15—·2 inch diameter, in fascicled axillary few-flowered cymes up to .5 inch long or sometimes solitary. Capsule .3—·4 inch long, turbinate, 3-celled, slightly lobed, smooth, brown. Seeds enclosed in a white aril.

Occurs throughout the subhimalayan tract and outermost ranges up to 4,000 feet. Fairly common, usually bordering streams either in forest or in the open. Flowers: March. Fruit: December. Some specimens collected in the Ramnagar Division have recently been described as *G. Championi*, Dunn., but I am unable to distinguish them from other specimens of *G. Falconeri*.

4. *ELÆODENDRON*, Jacq. f.

Trees or shrubs. Leaves opposite or subopposite; stipules minute, caducous. Flowers hermaphrodite, sometimes polygamous, in axillary dichotomous cymes. Calyx 5-lobed. Petals 5, spreading. Disk thick, often lobed. Stamens 5, inserted on the margin of the disk. Ovary adnate to the disk, 2—5-celled; ovules 2 in each cell. Fruit an indehiscent drupe, dry or succulent; stones 1—3-celled, cells 1- rarely 2-seeded. Seeds exarillate.

***Elæodendron glaucum*, Pers.** Vern. *Dhēbri*, G. *Ajān*, R.K. *Sauni* or *Loonia*, EA. *Sounria*, R.—A small or medium-sized deciduous tree up to 7 feet girth and 100 feet high. Twigs slender, glabrous. Bark fairly smooth, pale ashy or silvery-grey often blackish in part, with a thin mealy-corky exterior layer, breaking up into small soft scales. Blaze .25—·4 inch, rather hard, not fibrous, pink sometimes with darker streaks. Leaves opposite or subopposite, rarely alternate, 2—6 inches long, very variable, orbicular ovate elliptic or oblong, subcoriaceous, glabrous, acute or acuminate, crenate-serrate or subentire, shining above.

Petiole .5—1 inch long, channelled. Flowers .3 inch diameter, greenish-white or brownish, 4-5-merous, in lax axillary corymbose cymes 2—4 inches long. Peduncles slender, 1—2.5 inches long. Pedicels slender, .3—4 inch long. Drupe .4—7 inch long, ellipsoid or obovoid, yellowish-green, containing one stone surrounded by a soft greenish-yellow pulp.

Occurs throughout the area up to 4,500 feet. Common in dry miscellaneous forests, becoming scarce in the inner hill ranges. Flowers: June. Fruit: January—April.



XXVI.—RHAMNACEÆ.

Trees or shrubs, often scrambling or climbing; branches sometimes thorny, sometimes bearing tendrils. Leaves simple, alternate rarely opposite; stipules small or 0, sometimes changed into prickles. Flowers hermaphrodite or polygamous, small, greenish, in simple or panicked axillary cymes. Calyx 4—5 (rarely 6) -lobed, the lobes triangular, valvate, keeled within. Petals 4-5, rarely 0 or 6, inserted on the throat of the calyx-tube. Disk fleshy and filling the calyx-tube or membranous and lining it. Stamens as many as and opposite to the petals. Ovary free or immersed in the disk, 3- rarely 2—4-celled; style short, simple or 2—4-lobed. Fruit superior or inferior, 3- rarely 4-celled, capsular or drupaceous, sometimes winged. Seeds solitary in each cell.

I.—Fruit superior. Tendrils absent.

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| A. Fruit a samara. Climbers | ... | ... | 1. <i>Ventilago</i> . |
| B. Fruit a drupe. Stone 1—4-celled. | | | |
| 1. Leaves palmately 2—5-nerved. Stipules spiny | ... | ... | 2. <i>Zizyphus</i> . |
| 2. Leaves penninerved. Stipules not spiny | ... | ... | 3. <i>Berchemia</i> . |
| C. Fruit baccate, containing 2—4 pyrenes or cocci. | | | |
| 1. Disk thin. Shrubs or very small trees | ... | ... | 4. <i>Rhamnus</i> . |
| 2. Disk fleshy. | | | |
| (a) An unarmed large tree | ... | ... | 5. <i>Hovenia</i> . |
| (b) Shrubs usually armed, erect or climbing... | | | 6. <i>Sageretia</i> . |

II.—Fruit inferior. Tendrils present.

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|------------------------------------|-----|---------------------|
| 1. Leaves crenate. Fruit 3-winged | ... | 7. <i>Gouania</i> . |
| 2. Leaves entire. Fruit not winged | ... | 8. <i>Helinus</i> . |

1. VENTILAGO, Gaertn.

Climbing shrubs. Leaves alternate; stipules very small, caducous. Flowers small, bisexual, in panicles, rarely fascicled. Calyx 5-lobed; lobes spreading. Petals 5, hood-shaped. Stamens 5, adnate to the base of the petals. Disk 5-angled. Ovary sunk in the disk, 2-celled; ovules solitary in each cell. Fruit a 1 (rarely 2)-seeded nut, prolonged above by the style which is enlarged to form a linear-oblong coriaceous wing.

Ventilago calyculata, Tulasne. Vern. *Kali-bel*, EA. and RK.—A large evergreen climber with rambling stems up to 10 inches diameter and 100 feet high, climbing by means of strong woody tendrils. Bark

of stems up to about 5 inches diameter smooth with shallow, broad, reticulate woody ridges; of larger stems dark brown or blackish, rough with deep longitudinal fissures. Blaze .2—·35 inch, hard, fibrous, pinkish. Twigs greenish, smooth, more or less deeply striate, pubescent when young. Leaves 2—5 by 1·2·5 inches, ovate elliptic or elliptic-oblong, base obliquely acute or rounded, apex usually acuminate, entire or crenate, glabrous when mature, subcoriaceous, with 6—8 pairs of arcuate lateral nerves. Petioles .2—·4 inch long. Flowers .15—·2 inch diameter, pale yellowish-green in terminal pubescent panicles up to 9 inches long. Fruit a subglobose nut, .2 inch diameter, girt about the middle by the persistent calyx-rim and prolonged into a linear pubescent reticulate wing 1·5—2 by .3—·4 inch.

Occurs throughout the subhimalayan tract and central and outer hill ranges. Common in miscellaneous forest, especially along the banks of streams. The quite young leaves are usually tinged deep purplish-brown. Flowers: January—March. Fruit: May—June.

2. ZIZYPHUS, *Juss.*

Trees or erect or climbing shrubs, usually armed with sharp straight or hooked thorns which are transformed stipules; thorns solitary or in pairs, usually one straight, the other curved. Leaves alternate. Flowers small, greenish or yellowish, in axillary fascicles or cymes. Calyx 5-lobed. Petals 5, rarely 0. Disk more or less filling the calyx-tube. Ovary immersed in the disk, 2—4-celled; styles 2—4, free or connate. Fruit a drupe, sometimes nearly dry, with a woody or bony 1—4-celled and -seeded stone.

I.—Cymes or fascicles axillary. Petals present.

A. Erect trees or shrubs.

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|---|-----|----------------------|
| 1. Peduncles of cymes 0 or shorter than the pedicels. Fruit yellow or red | ... | 1. <i>Jujuba</i> . |
| 2. Peduncles mostly longer than the pedicels. Fruit greenish | ... | 2. <i>xylopyra</i> . |

B. Stem straggling or climbing. Fruit small, black

...	3. <i>Cenoplia</i> .
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II.—Cymes panicled. Petals 0. Sometimes climbing.

Fruit white	4. <i>rugosa</i> .
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1. **Zizyphus Jujuba**, *Lamk.* Vern. *Bēr*, Gen.—A small subdeciduous tree with dense spreading crown, commonly 2 feet girth and 20 feet high. Bark blackish to grey or brown, rough, regularly and deeply furrowed, the furrows about .5 inch apart. Blaze .35—·5 inch, short fibre, pink with or without paler streaks, the juice turning purplish-black on the blade of a knife. Branches usually armed with spines, mostly in pairs, one straight, the other curved. Young shoots more or less densely pubescent. Leaves 1·25—2·5 by 1·2 inches, oblong or ovate, usually minutely serrulate or apex distinctly toothed, obtuse, base

oblique and 3-nerved, nerves depressed on the glabrous shining upper surface, densely clothed beneath with white or buff tomentum. Petiole .1—4 inch long. Flowers .15—2 inch diameter, greenish, in dense axillary tomentose cymes or fascicles .5—75 inch long. Drupe .5—1 inch diameter, globose, first yellow then orange and finally reddish-brown, containing a single stone surrounded by fleshy pulp.

Occurs throughout the subhimalayan tract and outer hill ranges up to 2,500 feet. Abundant on waste lands and grazing grounds in the Bhabar. Flowers: June—September. Fruit: November—February.

A dwarf variety of this plant occurs abundantly throughout our area up to 4,500 feet. It is distinguishable from the type described above by the somewhat smaller leaves and by the stems seldom exceeding 5 feet high. It is gregarious on waste places and dry grazing grounds in the Bhabar. Mr. H. H. Haines has named a similar variety in central India *var. fruticosa*, but his variety does not appear to me to be the same as ours.

2. *Zizyphus xylopyra*, Willd. Vern. *Bhandēr* or *Kathber*, Gen.—A large deciduous shrub or small tree with wide spreading crown and stem up to 2.5 feet girth and 25 feet high. Twigs rusty-tomentose. Branches often armed with pairs of small spines, one straight, the other curved. Bark dark brown or blackish, more or less deeply cracked, exfoliating in small woody scales, but smooth on stems up to about 5 inches diameter. Blaze .5—6 inch, fibrous, bright reddish (pink on immature stems). Leaves 1—3.5 inches long, broadly elliptic, obovate or suborbicular, crenate-serrate, base oblique and often subcordate, pubescent on the nerves above, brown-pubescent beneath, 3—5-nerved. Petiole .1—3 inch long. Flowers .2 inch diameter, yellowish-green, in dense axillary pubescent peduncled cymes .3—1 inch long. Drupe .7—1 inch diameter, greenish-yellow often tinged pink, frequently shrivelling and turning dark brown on the tree without falling, the tissue surrounding the stone becoming dry and almost woody.

Occurs throughout the subhimalayan tract and outer hill ranges up to 4,000 feet. Very common in open dry miscellaneous and *sal* forests of the Bhabar. Flowers: May—July. Fruit: February—March.

3. *Zizyphus Cnopia*, Mill.—A straggling evergreen shrub becoming a fairly large climber up to 30 feet high and 3 inches diameter. Twigs slender, brown-tomentose. Bark dark grey or blackish, rather rough and more or less deeply cracked. Blaze red or claret-coloured narrowly streaked and mottled with pale yellowish-brown or white. Branches usually armed with spines, solitary or in pairs, one stout curved, the other more slender and straight. On old stems the prickles are raised on a pyramidal woody base up to .75 inch high which may ultimately split in two with the expansion of the stem. Leaves 1—2.5

inches long, ovate or ovate-lanceolate, oblique, acute or shortly acuminate, obscurely toothed or entire, pubescent or glabrous above, with copious brown silky adpressed hairs beneath, 3—5-nerved. Petiole .1—·3 inch long. Flowers .1 inch diameter, in brown-tomentose axillary cymes under .5 inch long. Drupe .25—·35 inch diameter, globose, black, shining, succulent.

Occurs throughout the subhimalayan tract up to 2,000 feet. Fairly common in open forest. Flowers : June—August. Fruit : December—February.

4. *Zizyphus rugosa*, Lamk.—A large evergreen or subdeciduous shrub or small tree, either erect with spreading and drooping branches or scandent the rambling branches attaining 40 feet high; stem up to 4 feet girth. Branches often armed with solitary hooked prickles up to .3 inch long, only one stipule being thus transformed. Twigs densely rusty-tomentose. Bark brown, rough, woody, with deep irregular cracks, exfoliating in small hard scales. Blaze .3—·8 inch, somewhat fibrous, deep pink with paler bands, ultimately pinkish to bright reddish throughout, juice turning purple on the blade of a knife. Leaves 3—6 by 2·25—4·5 inches, broadly elliptic or suborbicular-ovate, finely serrulate, base subcordate, upper surface dark glossy green, glabrous or glabrescent when mature, lower surface clothed more or less densely with pale or rusty tomentum, base strongly 3-nerved the lateral pair usually forked near the base. Petiole .25—·6 inch long. Flowers .2—·25 inch diameter, yellowish-green, in rusty-tomentose pedunculate cymes arranged in axillary sometimes leaf-bearing panicles up to 8 inches long, usually on leafless branches. Drupe .3—·5 inch diameter, white, fleshy.

Occurs in the subhimalayan tract but has not been recorded west of the Kalagarh Division. Fairly common in open dry miscellaneous forests of the Bhabar. Flowers : March-April. Fruit : June-July.

3. *BERCHEMIA*, Neck.

Shrubs, usually climbing, or small trees. Leaves alternate, entire or nearly so, with numerous parallel secondary nerves. Flowers bisexual or polygamous, fascicled, the fascicles often arranged in spikes or panicles. Calyx 5- rarely 6-lobed. Petals 5, rarely 6. Disk lining the calyx-tube, margins free. Ovary sunk in the disk but not confluent with it, 2-celled; style 2-fid. Drupe hard or fleshy, seated on the persistent calyx-tube; stone 2-celled, 2-seeded.

A large climber. Leaves 2—4 inches long ... 1. *floribunda*.

An erect shrub. Leaves .5—1·5 inches long ... 2. *lineata*.

1. *Berchemia floribunda*, Wall. Vern. *Helonia*, EA.—A large deciduous climber with rambling stems up to 30 feet high and 4 inches diameter. Twigs glabrous. Bark of branches up to about 1·5 inches diameter, smooth, dark green or blackish; of old stems, rough, dark brown,

exfoliating in thin hard pieces. Blaze .1—1.5 inch, rather fibrous, hard, pink, the innermost layers of dead tissue often deep purple. Leaves 2—4 inches long, elliptic or ovate-oblong, tip rounded or acuminate, base rounded or subcordate, glabrous, entire, dark green above, paler beneath, with 9—12 pairs of conspicuous parallel secondary nerves. Petiole .5—1 inch long. Flowers .05—1 inch diameter, greenish, very numerous, in fascicles arranged in a large terminal pubescent panicle, the lower branches often in the axils of leaves. Pedicels .05—1 inch long. Drupe .3—1.4 inch long, ovate-oblong, black when ripe.

Occurs throughout the central and outer hill ranges between 2,000 and 6,000 feet. Flowers: March—May, also July—September (?). Fruit: July.

2. *Berchemia lineata*, DC. Syn. *B. Edgeworthii*, Laws. Vern. *Kamēti*, NG.—A deciduous shrub 3—8 feet high, the stems occasionally reaching 15 feet high and 1 inch diameter when supported by surrounding vegetation. Stems frequently arched and rooting in contact with the ground. Twigs terete, glabrous. Bark dark green or blackish, quite smooth. Leaves variable in size, .5—1.5 by .3—1.8 inch, elliptic or oblong, apex rounded or obtuse, entire, base rounded, glabrous, thin, with 6—8 pairs of conspicuous parallel secondary nerves, pale and glaucous beneath. Petiole .2—1.4 inch long. Flowers .15—1.2 inch diameter, yellowish-green, in axillary clusters of 2—4. Pedicels .1—1.2 inch long. Drupe .3—1.4 inch long, ovoid or oblong (cylindric till ripe), purplish-black with a waxy bloom, containing a single white stone, succulent.

Occurs throughout the hills between 7,000 and 9,000 feet. Fairly common on limestone soils and often associated with cypress and *Quercus dilatata*. Flowers: May—September. Fruit: June—October.

4. RHAMNUS, Linn.

Small trees or shrubs. Leaves alternate, rarely subopposite; stipules small, deciduous. Flowers hermaphrodite or polygamous, in axillary fascicles or in simple or compound racemes. Calyx-tube urceolate, lobes 4-5. Petals 4-5 or 0. Disk lining the calyx-tube, the margin thin. Ovary free, 3-4-celled; styles distinct or somewhat connate. Fruit a fleshy berry-like drupe, seated on the persistent calyx-tube; pyrenes 2—4, crustaceous.

I.—Erect trees or shrubs.

A. Branches often ending in a thorn. Flowers 4-merous ... 1. *virgata*.

B. Unarmed. Flowers 5-merous.

1. Deciduous. Leaves membranous, upper surface glabrous, Bark smooth ... 2. *purpureus*.
2. Evergreen. Leaves subcoriaceous, upper surface minutely pubescent. Bark rough... 3. *triqueter*.

II.—Dwarf or procumbent shrubs (rarely suberect).

1. Evergreen. The larger leaves exceeding .8 inch long ... 4. *procumbens*.
2. Deciduous. Leaves .3—1.8 inch long ... 5. *prostrata*.

1. *Rhamnus virgata*, Roxb. Syn. *Rhamnus dahurica*, Pall. Vern. *Chēdul* or *Chēdula*, Gen. *Chatiul*, EA. *Chētula*, NG.—An erect deciduous shrub 6—15 feet high and stem up to 3 feet girth. Branches often ending in a sharp thorn. Young shoots minutely pubescent. Young stems and branches quite smooth, the bark peeling off in lateral papery rolls. Bark on old stems dark reddish-brown, rough. Blaze .2—·35 inch, bright orange or orange-brown, with numerous fine white fibres running through. Leaves opposite or subopposite (fascicled on dwarf shoots), 1—4 inches long, variable from narrowly elliptic-lanceolate to broadly ovate or obovate, thin, membranous, slightly pubescent on both surfaces, acuminate, base acute, crenate-serrate, lateral nerves arcuate. Petiole .2—·4 inch long, pubescent. Flowers .2 inch diameter, pale green, 4-merous, unisexual in many-flowered axillary clusters. Pedicels .2—·3 inch long, filiform. Fruit .2—·35 inch diameter, globose, shining, black, containing 1-2, usually 2, dark brown seeds embedded in a purplish juicy pulp.

Occurs throughout the hills between 2,000 and 10,000 feet. Very common in oak forest, also in secondary types. Flowers: March—May. Fruit: June—October.

2. *Rhamnus purpureus*, Edgew.—A large deciduous shrub with spreading branches or occasionally a small tree up to 25 feet high and 9 inches diameter. Young shoots minutely puberulous. Twigs with numerous pale lenticels, emitting a foetid smell when bruised, sometimes purplish. Bark pale grey or ashy, smooth. Blaze .3—·4 inch, orange-brown with or without yellow bands, the innermost layer yellowish, the whole interspersed with white thread-like strands, often tinged with chlorophyl towards the exterior. Leaves alternate, 2—6 inches long, elliptic obovate or oblong, acuminate, thin, membranous, pubescent beneath when quite young, remaining bearded in the axils of the nerves but otherwise glabrous when mature, serrate, with 7—11 pairs of strong secondary nerves depressed on the upper surface. Petiole .3—·5 inch long. Flowers .15—·25 inch diameter, greenish-purple, 5-merous, bisexual, in axillary clusters. Pedicels .1—·4 inch long. Fruit .3—·4 inch diameter, globose, shining, first pink then black when fully ripe.

Occurs throughout the hills between 6,000 and 9,000 feet. Fairly common in shady oak forest. The flowers appear with the new leaves. Flowers: April-May. Fruit: July-October.

3. *Rhamnus triqueter*, Wall. Vern. *Gaunth*, G. *Gaunta*, A.—An evergreen shrub or small tree up to 20 feet high and 3 feet girth. Bark dark brown or blackish, rough, exfoliating in small irregular woody scales. Blaze .25 inch, orange-brown with coarse whitish fibres running through. Shoots grey-tomentose when young. Twigs with

numerous small circular lenticels. Leaves 2·5—5·5 by 1·2·5 inches, ovate-oblong or elliptic, acute, base usually rounded, minutely crenate-serrate, subcoriaceous, minutely pubescent and dull green above, finely grey-tomentose beneath, with 8—12 pairs of arcuate secondary nerves prominent beneath. Petiole 3—1 inch long, grey-tomentose, channelled above. Flowers 1—2 inch diameter, yellowish-green, 5-merous, bisexual, in grey-tomentose cymes which are arranged in axillary racemes 1—3 inches long, usually bearing a few small leaves. Pedicels 1 inch long or less. Fruit 2—3 inch diameter, globose or slightly obovoid, indistinctly 3-lobed, purplish-black. Seeds 2—4.

Occurs throughout the hills between 3,000 and 7,000 feet. Fairly common in dry miscellaneous forest; often found on hot southern aspects on a limestone soil. I have measured an unsound tree 5 feet girth and 25 feet high near Naini Tal. Flowers: July-September. Fruit: October-December.

4. *Rhamnus procumbens*, Edgew.—A small evergreen shrub with creeping or prostrate stems, rarely suberect and attaining 6 feet high and 75 inch diameter. Young shoots pubescent. Leaves alternate, large and small leaves usually alternating in regular order; the larger 8—2·5 inches long, lanceolate, narrowed at both ends; the smaller 25—7 inch long, ovate or orbicular with rounded base and obtuse or rounded tip; all cuspidate-serrate, glabrous, dark glossy green above, paler and glossy beneath, midrib depressed above and prominent beneath, main lateral nerves 3—4 pairs rather indistinct. Petiole 05—15 inch long. Flowers 1 inch diameter, green, 5-merous, bisexual, axillary, usually solitary. Pedicels 2—3 inch long, filiform. Fruit 15—2 inch diameter, subglobose, blue-black, containing 2-3 seeds embedded in purple juicy pulp.

Occurs throughout the hills between 6,000 and 9,000 feet. Generally scarce but sometimes not uncommon on limestone soils, usually in open places and on rocks. Flowers: June—August. Fruit: January—April.

5. *Rhamnus prostrata*, Jacquem. Vern. *Koni* or *Kauntia*, NG.—A dwarf deciduous rigid shrub with dense interlacing branches which often become subspinescent at the tips. Stems 1—3 feet high and up to 1 inch diameter, erect or spreading and decumbent. Bark smooth, peeling off in thin lateral rolls. Blaze bright orange-yellow, with white hair-like fibres running through. Young shoots pubescent. Leaves alternate (fascicled on dwarf shoots), 3—8 by 2—3 inch, elliptic or elliptic-oblong, obscurely serrate or sometimes entire, glabrous or minutely tomentose on both sides, rather glossy on both surfaces. Flowers minute, green, fascicled on arrested side-shoots. Pedicels 1—15 inch long, slender. Fruit 2 inch long, obovoid, 3-lobed, 3-celled, containing 2-3 seeds.

Occurs on the drier ranges bordering Tibet between 10,000 and 14,000 feet. Fairly common on open stony south slopes, also sometimes in blue pine and *deodar* forest. Flowers: May. Fruit: August.

5. HOVENIA, *Thunb.*

A tree. Leaves alternate. Flowers in axillary and terminal cymes. Calyx 5-fid; tube broadly obconical. Petals 5, inserted below the disk, clawed. Stamens 5, a little longer than the petals. Disk lining the calyx-tube, the margin free and hairy. Ovary sunk in the disk, 3-celled; style 3-cleft. Fruit indehiscent, 3-lobed, with thickened pedicels.

Hovenia dulcis, *Thunb.* Vern. *Wonga* or *Charkuttia*. NG.—A medium-sized or large deciduous tree up to 11 feet girth and 100 feet high. Bark of young trees smooth, pale ashy or whitish; of old trees pale brown, rough, with deep and regular vertical furrows up to 1.5 inches apart. Blaze 4—1 inch, rather fibrous, pink or pinkish-brown. Young shoots pubescent, with elongated pale lenticels. Leaves 4—6 by 2.3.5 inches, ovate or elliptic, acuminate, base often unequal, 3-nerved, membranous, serrate, glabrescent above, hairy on the nerves beneath; lateral nerves 3—5 pairs, arching and anastomosing within the margin. Petiole .5—1 inch long. Flowers .2 inch diameter, greenish-white, in solitary or twin, axillary and terminal, pedunculate, many-flowered, tomentose cymes 1—3 inches long. Pedicels .05 inch long, slender. Fruit .3 inch diameter, globose, succulent, 3-celled and 3-seeded with a tough outer covering which separates from the membranous endocarp. The cyme-branches thicken irregularly as the fruit ripens and become fleshy.

Occurs throughout the central and inner hill ranges between 3,000 and 6,000 feet. Rather scarce and usually found in moist shady forest often bordering streams. The lateral woody shoots usually about 1 foot long are mostly deciduous and may be found collected beneath the tree when the leaves have fallen. Flowers: May-June. Fruit: October-December.

6. SAGERETIA, *Brongn.*

Straggling or climbing shrubs, usually armed with thorns which are frequently recurved. Leaves subopposite; stipules minute, deciduous. Flowers hermaphrodite, small, in fascicles, the fascicles arranged in spikes or panicles. Calyx-tube hemispheric; lobes 5, acute. Petals 5, clawed, enclosing the stamens. Stamens 5, about equalling the petals. Disk cup-shaped, filling the calyx-tube, margin free, 5-lobed. Ovary free, enclosed by the disk, 3-celled; style short; stigmas 3. Fruit globose, 3-celled, indehiscent; pyrenes 3.

I.—Climbers or rarely suberect with sarmentose branches. Armed with stout deflexed lateral thorns. Leaves exceeding 2 inches long.

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|--|-----|---------------------------|
| 1. Panicles often 12 inches long or more | ... | 1. <i>oppositifolia</i> . |
| 2. Panicles shorter than the leaves | ... | 2. <i>hamosa</i> . |

II.—An erect shrub with stiff branches. Sometimes armed with terminal straight thorns. Leaves not exceeding 2 inches long

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|-----|-----|----------------------|
| ... | ... | 3. <i>theezans</i> . |
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1. *Sageretia oppositifolia*, Brongn. Vern. *Abinkand*, NG. *Abinkania*, RK. *Lohari*, A.—A subdeciduous shrub with sarmentose or climbing branches, the stems attaining 50 feet high and 5 inches diameter. Usually armed with stout, straight, sometimes leaf-bearing, thorns up to 1·5 inches long, mostly deflexed. Bark smooth, grey or pinkish-brown, exfoliating in patches and exposing the pale buff under-bark. Blaze 2·5 inch, hard, not fibrous, pink. Young shoots tomentose. Leaves 2—5 by 1—2·5 inches, ovate-oblong, acute or acuminate, serrate but sometimes obscurely so, clothed when young especially beneath with deciduous woolly tomentum, base rounded or subcordate, subcoriaceous, with 5—9 pairs of lateral nerves strongly impressed above and prominent beneath, glabrous and glossy on both surfaces when mature. Petiole 2—5 inch long. Flowers 0·5—1 inch diameter, greenish-yellow, sessile, in long, narrow, terminal, villous panicles, the lower branches usually in the axils of leaves. Fruit 2—3 inch long, obovoid, black or purplish-red when ripe.

Occurs throughout the hills between 2,000 and 7,000 feet. Fairly common, often in hedgerows or secondary forest. Flowers: September-October. Fruit: April-June.

2. *Sageretia hamosa*, Brongn.—A climber with long slender straggling branches, usually armed with stout deflexed thorns. Bark reddish-brown. Twigs ribbed or lined, closely lenticellate. Young shoots and immature leaves sparsely hairy and soon becoming quite glabrous. Leaves 2·5-5·5 by 1·25—2 inches, elliptic-oblong or oblong-lanceolate, acuminate, base rounded, finely and closely serrate, with 7—10 pairs of lateral nerves impressed above and prominent beneath, shining on both surfaces. Petiole 1·5—4 inch long. Flowers small, sessile, in terminal and axillary villous panicles shorter than the leaves.

Specimens, in leaf only, of this plant have been collected by Mr. W. J. Lambert in East Almora where he found it growing at 3,000 feet in the Ukhaldhunga Reserve and again at 6,000 feet at Panwanoula in the Central Almora Division. Though only in leaf, the specimens are fairly conclusive. Flowers: September-October.

3. *Sageretia theezans*, Brongn. Vern. *Kutku*, *Khadgu* or *Kurkha*, NG.—An evergreen shrub 5—10 feet high with stiff branches sometimes terminating in thorns. Twigs pubescent. Leaves 5—2 inches long, elliptic or suborbicular, coriaceous or subcoriaceous, serrate or almost entire, glabrous or nearly so, with 4—6 pairs of lateral nerves. Petiole 0·5—2 inch long, tomentose on the upper surface. Flowers less than 1 inch diameter, green, sessile, in axillary and terminal interrupted spikes or panicles shorter than the leaves. Fruit 2 inch long, black.

Occurs in North Garhwal along the main Himalayan range between 4,000 and 8,000 feet. Very common along the Dhaul valley between Joshima'h and Tapoban where it grows in open scrub forest bordering cultivation. Flowers: May-June.

7. *GOUANIA*, Linn.

Unarmed shrubs, climbing by means of tendrils on the branchlets and at the base of the inflorescence. Leaves alternate; stipules deciduous. Flowers small, polygamous, fascicled on the rachis of spikes or racemes which are sometimes panicle. Calyx-tube short; lobes 5. Petals 5, inserted below the margin of the disk. Disk filling the calyx-tube, with 5 rounded or horn-like lobes alternate with the stamens. Stamens 5, enclosed within the petals. Ovary sunk in the disk, 3-celled; style 3-cleft; ovules solitary. Fruit coriaceous, inferior, 3-winged or sharply angled, splitting into 3 cocci through the wings and leaving a slender axis.

***Gouania leptostachya*, DC.**—A large rambling climber with stem up to 5 inches diameter and 80 feet high. Tendrils up to 8 inches long, terminal. Twigs smooth, terete, often pendent, bright green at first. Bark brown, rough, with a fine network of deep or shallow furrows. Blaze 2—6 inch, pink to deep claret-red, sometimes with a few pale bands towards the exterior, juice turning blue or purple on the blade of a knife. Leaves 2·5—4·5 by 2—4 inches, ovate, abruptly acuminate, cordate, crenate, pubescent on the nerves beneath when young, dark glossy green above, pale and rather glossy beneath, with 4—7 pairs of arcuate secondary nerves prominent beneath. Petiole 75—3 inches long, channelled. Flowers 2 inch diameter, creamy-white, fascicled on the rachis of simple or panicle terminal pubescent racemes 6—12 inches long. Pedicels 0·5 inch long. Capsule 4 inch long, 3-winged, brown and dry. Seeds 3, dark brown, polished.

Occurs throughout the subhimalayan tract and outer hill ranges between 1,000 and 3,000 feet. Common in dry miscellaneous forest, also in swampy ground. Flowers: August-September. Fruit: January-February.

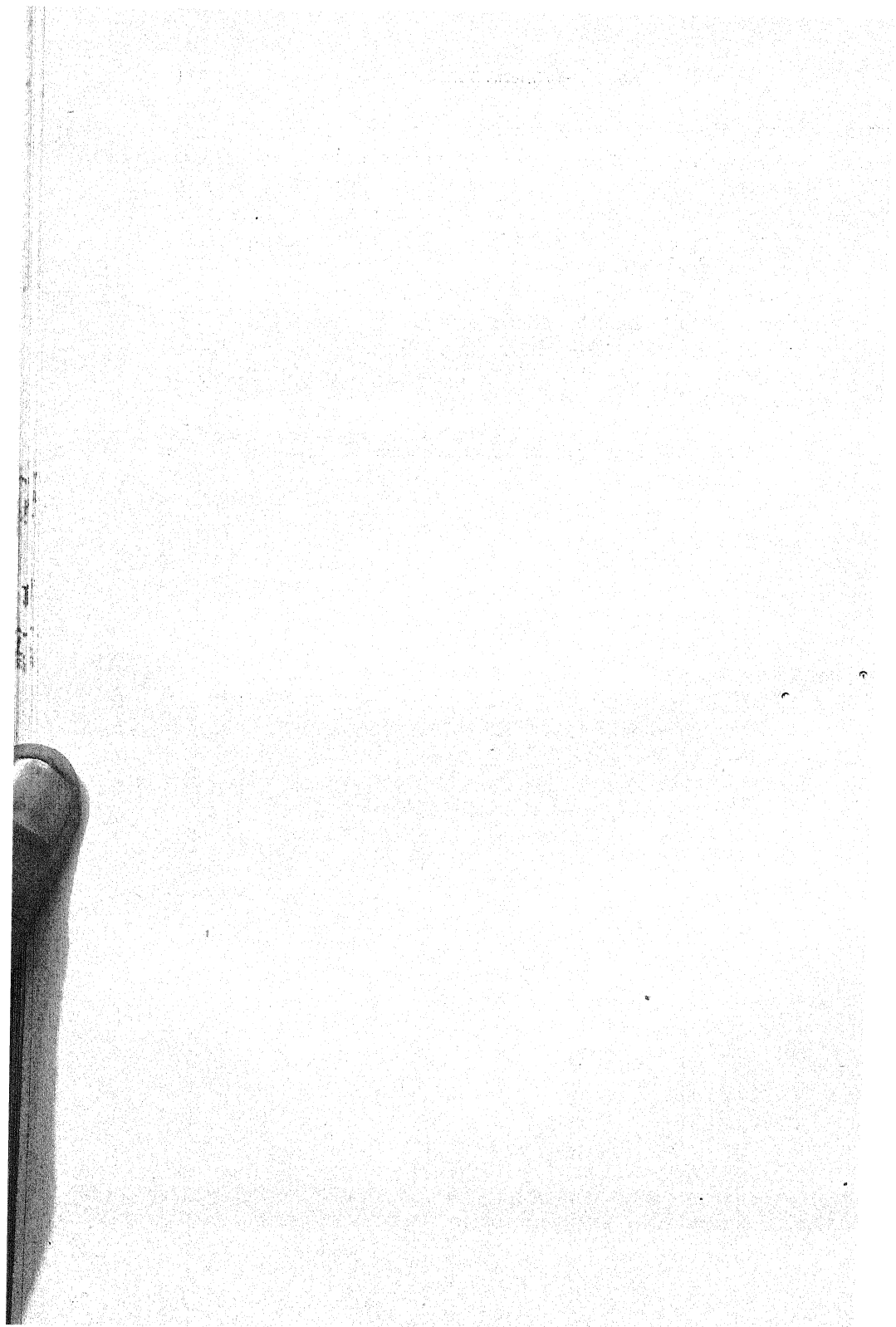
8. *HELINUS*, E. Meyer.

Unarmed shrubs, climbing by means of tendrils. Leaves alternate, entire; stipules small, deciduous. Flowers small, umbellate. Calyx 5-lobed. Petals 5, inserted on the margin of the disk. Disk epigynous, filling the calyx-tube. Stamens 5, as long as the petals. Ovary inferior, 3-celled; style short, 3-cleft; ovules solitary. Fruit 3-celled, tardily separating into 3 crustaceous cocci attached to a central axis, the cocci dehiscent interiorly.

***Helinus lanceolatus*, Brandis.**—A slender evergreen climber with flexible wiry stems up to 25 feet high and 5 inch diameter, climbing by means of simple terminal tendrils up to 2 inches long. Twigs green, faintly striate, glabrous or puberulous. Bark slightly rough, reddish-

brown. Leaves 1·5—3 by ·4—1·3 inches, smaller towards the ends of the shoots, lanceolate, entire, gradually narrowed to a point, base rounded, glabrous or nearly so, paler and somewhat glaucous beneath with 4-5 pairs of secondary nerves, the lowest pair basal. Petiole up to ·6 inch long, slender, hairy. Flowers ·15—·25 inch diameter, greenish-yellow, in slender peduncled cymes which are axillary or paniculate by reduction of the leaves. Calyx-lobes first white then pale yellow inside, green outside. Petals minute, folded round the filaments. Disk shining, white. Peduncle ·5—1 inch long. Pedicels filiform, ·1—·3 inch long. Fruit capsular, ·2-·3 inch diameter, obovoid, 3-seeded. Seeds shining, black.

Occurs throughout the area between 1,500 and 4,000 feet. Fairly common on dry southern aspects and in secondary scrub forest. Flowers: February—May. Fruit: May-June.



XXVII.—VITACEÆ.

Erect or climbing shrubs, rarely small trees, the former usually tendril-bearing. Leaves alternate, simple or compound, stipulate; petiole often thickened at the base. Flowers regular, hermaphrodite or unisexual, in cymes usually opposite the leaves; peduncles often transformed into tendrils or tendril-bearing. Calyx small, 4—5-lobed or truncate. Petals 4—5, valvate, free or connate, caducous. Disk annular or expanded. Stamens 4-5, opposite the petals, inserted on or outside the disk. Ovary usually sunk in the disk, 2—6-celled; ovules 1-2 in each cell; style short; stigma small. Fruit an indehiscent 1—6-seeded berry.

Climbers. Stamens free. Ovary 2-celled ... 1. *Vitis*.

Erect. Stamens connate and adnate to the petals.

Ovary 3—6-celled. ... 2. *Leea*.

1. VITIS, *Linn.*

Herbs or shrubs climbing by means of a modification of the stem or branches into tendrils, which sometimes bear the inflorescence. Leaves simple and palmately nerved or digitate or pedate. Flowers 4-5-merous. Petals often calyptrate. Disk of glands or lobed or annular. Stamens free. Ovary 2-celled, very rarely 4-celled, surrounded at the base or half way up by the disk; ovules 2 in each cell. Berry 1—4-seeded.

I.—Leaves simple, often angled or lobed (usually 3-foliolate in no. 4).

A. Flowers 4-merous, red. Stem perennial.
Inflorescence not bearing tendrils ... 1. *repanda*.

B. Flowers 5-merous. Inflorescence usually tendril-bearing.

1. Flowers red. Stems annual.

(a) Leaves glabrescent when mature ... 2. *latifolia*.

(b) Leaves with a persistent dense felted tomentum beneath.

(i) Leaves simple ... 3. *rugosa*.

(ii) Leaves usually trifoliolate ... 4. *divaricata*.

2. Flowers green. Stems perennial.

(a) Leaves 1.5—4 inches broad, glabrescent ... 5. *parvifolia*.

(b) Leaves 4—8 inches broad, hairy.

(i) Lower surface of mature leaves only hairy on the nerves ... 6. *pedicellata*.

(ii) Lower surface of mature leaves clothed all over with dense rusty tomentum ... 7. *lanata*.

II.—Leaves 3-foliolate. Flowers usually 4-merous, green.
Inflorescence not bearing tendrils.

1. Petiolule of terminal leaflet 0—2 inch long 8. *semicordata*.
2. Petiolule of terminal leaflet .2—1 inch long 9. *trifolia*.

III.—Leaves 5-foliolate as a rule.

A. Leaves pedate (rarely digitate by suppression).

1. Leaves more than 1.5 inches broad ... 10. *lanceolaria*.
2. Leaves less than 1.5 inches broad.

(a) Stems climbing by means of adventitious roots as well as tendrils. Midrib and secondary nerves conspicuously pale above ... 11. *capriolata*.

(b) Stems climbing only by tendrils. Midrib and secondary nerves not or scarcely paler above.

(i) Seed deeply corrugated on the sides and with 3 prominent dorsal ridges ... 12. *affine*.

(ii) Seed rugose all over with a single dorsal depression ... 13. *species*.

B.—Leaves digitate.

1. Tendrils palmately 5—9-branched ... 14. *obtecta*.
2. Tendrils simple ... 15. *Parkeri*.

1. *Vitis repanda*, W. and A. Vern. *Pan-lagula*, R.—A large deciduous climber with stems up to 6 inches diameter and 80 feet high. Bark pale brown, rough, slightly corky and more or less deeply furrowed. Blade .35—.5 inch, rather crisp, fibrous, pale orange, the juice turning purplish-black on the blade of a knife. Young shoots, underside of leaves and inflorescence clothed with fine caducous rusty tomentum. Tendrils several times forked, but often only the main axis and lowest branch subsequently develop. Leaves simple, 5—10 and sometimes up to 15 inches diameter, broadly ovate or orbicular, deeply cordate, more or less sharply toothed the main nerves projecting beyond the margin of the leaf in points, dull green, glabrous or nearly so when mature. Petiole varying in length up to 12 inches. Flowers dull red, 4-merous, in umbels terminating the branches of a pedunculate branched leaf-opposed cyme. Pedicels .1—.3 inch long. Petals usually not cohering at the apex, rusty-pubescent outside. Fruit .3-.4 inch long, pyriform, usually 1-seeded.

Occurs throughout the area up to 4,000 feet. Very common in sal forest especially on north aspects. I have not separated *V. rosea*, Royle which according to Duthie differs in its larger leaves, pink instead of white (*sic*) flowers, and fusiform fruit. Flowers: June-July. Fruit: July-August.

2. *Vitis latifolia*, Roxb. Vern. *Bhimana*. *Bhimra*. (these names are also applied to other vines especially *V. rugosa*, Wall.)—A climber with annual stems 10-20 feet long and .3—.5 inch diameter which are scarcely woody. Bark smooth, green, often tinged purple especially at the nodes, covered with a thin glaucous bloom. Young

shoots glabrous or nearly so, hollow. Tendrils forked. Leaves simple, 5—10 inches broad, orbicular, 3—7-angled or-lobed, sometimes lobed half way down, crenate-serrulate or dentate, cordate, mealy when very young, glabrescent or with pubescent nerves when mature, often tinged with pink or purple beneath, base 5—7-nerved. Petiole varying in length up to 8 inches, deeply grooved above. Flowers .1 inch diameter, dark red, 5-merous, in pyramidal paniced pubescent cymes borne on a very stout peduncle together with a forked tendril. Petals not cohering at the apex, recurved, glabrous on both surfaces. Stamens bright yellow. Fruit .3—·35 inch diameter, globose, black, succulent.

Occurs throughout the area up to 4,000 feet. Very common in the subhimalayan tract, but rather scarce within the hills. Frequent in secondary scrub growth. Flowers : July-August. Fruit : September-October.

3. *Vitis rugosa*, Wall. Syn. *V. macrophylla*, Madden. Vern. *Chhipāri*, G, (this name is also applied to most other species of *Vitis*).—A climber with scarcely-woody annual stems 2—10 feet long and up to .75 inch diameter usually trailing over the ground. Stem with shallow longitudinal ribs and numerous small warty excrescences, usually pink or red. Leaves 5—18 inches diameter, broadly ovate or suborbicular, apex acute, base deeply cordate, minutely toothed, often obscurely 3—5-lobed, all the nerves depressed on the upper surface, base 5-nerved, upper surface clothed with long woolly tomentum when young pubescent when mature, lower surface clothed with persistent dense felted tomentum varying from greenish-white to deep rusty-red. Petiole 2—9 inches long, stout, usually pink or red. Flowers minute, red, 5-merous, in spreading branched pedunculate panicles 1—5 inches long, the branches densely woolly-tomentose, the peduncle often bearing a bifurcated tendril .5—3 inches from the base. Pedicels .05 inch long or less, stout. Fruit .3-.4 inch diameter, globose, black, shining. Seeds 1—4.

Occurs throughout the hills between 5,500 and 7,000 feet. Fairly common on steep grassy or rocky slopes either in open forest or on bare slopes, especially on limestone. The woody rootstock is frequently wedged into crevices in rocks. Flowers : June-July. Fruit : September—November.

4. *Vitis divaricata*, Wall.—A climber with scarcely-woody annual stems arising from a perennial woody rootstock. Stems 10—20 feet long and up to .5 inch diameter, deeply striate, usually pink or reddish, clothed with long, whitish, cottony, caducous tomentum. Leaves usually 3-foliolate, but sometimes simple or more or less deeply 3-lobed especially towards the end of the shoot. Petiole up to 5 inches long, striate on one side, usually pink or reddish. The simple or lobed leaves up to 6 by 5 inches, ovate, cordate. The terminal leaflet of trifoliolate leaves up to 8 by 3.5 inches, elliptic-lanceolate or narrowly ovate, base cuneate; the lateral leaflets smaller with very oblique base; all acuminate, finely

cuspidate-serrate or subentire, thin, membranous, all the nerves very depressed above, clothed on both surfaces with cottony tomentum when quite young, minutely pubescent above and more or less densely clothed with pale woolly tomentum beneath when mature. Flowers small, red, 5-merous, in dense 2-3-chotomous divaricate tomentose cymes. Peduncle 2—6 inches long, bearing a bifurcated tendril below the flowers. Petals spreading. Fruit 2—4 inch diameter, globose, black. Seeds 1—4.

Occurs throughout the hills between 4,000 and 7,000 feet. Fairly common in open forest or on bare ground. Flowers: July. Fruit: October-November.

5. *Vitis parvifolia*, Roxb.—A deciduous climber with slender trailing stems up to 15 feet high and 1 inch diameter. Bark dark reddish-brown, rough, peeling off in long fibrous strips. Young shoots glabrous, only the flattened tip clothed with pink hairs. Tendrils up to 5 inches long, forked once about the middle. Leaves 2—6 by 1.5—4 inches, ovate, base truncate or cordate, acuminate, sharply serrate sometimes deeply so, often 3-lobed, thin, membranous, bearded in the axils of the 5 strong basal nerves beneath, otherwise glabrous on both surfaces or puberulous on the nerves beneath, glossy on both surfaces especially beneath. Petiole 7—2 inches long, minutely pubescent when young, ultimately glabrous. Flowers minute, green, scented, in umbellate fascicles arranged in narrow usually bifurcated panicles 1—3 inches long. Pedicels 1.2 inch long, slender. Petals 5 (rarely 6), cohering at the apex. Fruit 2—4 inch diameter, globose, black. Seeds 1—4, smooth.

Occurs throughout the hills between 2,000 and 6,000 feet. Fairly common in mixed *banj* and *chir* forest and in secondary miscellaneous forest. Flowers: April-May. Fruit: July-August.

6. *Vitis pedicellata*, Laws.—A large deciduous climber with stem up to 4 inches diameter and 50 feet high. Bark reddish-brown, rough, exfoliating in fibrous strips. Tendrils forked. Young shoots and very young leaves densely clothed with caducous rusty tomentum. Leaves simple, 6—10 by 4.5—8 inches, broadly ovate, cordate, sometimes shallowly 3-lobed the lobes with shortly acuminate tips, dentate the teeth apiculate, ultimately glabrescent above but persistently hairy on the nerves beneath with stiff spreading rusty hairs, base 5-nerved, the secondary nerves prominent beneath. Flowers 5-merous, in umbels terminating the branches of pyramidal, paniced, pubescent cymes 1—3 inches long borne on rather slender long peduncles together with a simple tendril. Pedicels filiform, .05—2 inch long. Petals green, cohering at the apex, glabrous outside. Fruit .3 inch diameter, globose, black, with 2-3 pyriform seeds.

This vine is common in the oak forests of the Malla Chandpur and Kankrakhet reserves in North Garhwal, but its further distribution is uncertain. It is found between 6,000 and 8,500 feet. Flowers: June-July. Fruit: October. My specimens numbers 415, 462 and 673 are taken as belonging to this species.

7. *Vitis lanata*, Roxb. Vern. *Puliāna* or *Pudīna*, G. *Purāni* or *Purain*, A.—A large deciduous climber with stems up to 8 inches diameter and 60 feet high. Bark rough, dark reddish-brown, peeling off in fibrous strips. Blaze .2—4 inch, very fibrous, white. Young shoots, petioles and undersurface of leaves covered with white felted tomentum, or sometimes reddish-brown on the shoots and petioles. Tendrils bifurcating once, and then one of the two branches bifurcating again. Leaves 4—9 by 4—8 inches, broadly ovate from a truncate or cordate base, sometimes angled or obscurely lobed, shortly acuminate, dentate or sharply serrate, glabrous or nearly so above when mature, densely clothed beneath with deep rusty tomentum. Petiole 1.5—7 inches long. Flowers 5-merous (sometimes 6), scented, in rather dense pyramidal densely tomentose panicles 2.5—8 inches long usually bearing a bifurcated tendril 1-2 inches from its base. Petals green, cohering at the apex, glabrous outside. Pedicels slender .05—15 inch long. Fruit .3 inch diameter, black with a transparent bloom. Seeds 1—4, obovoid.

Occurs throughout the hills between 3,000 and 7,000 feet. Common in *banj* forest, also in dry miscellaneous forest below the oak zone especially in ravines. Flowers: April—June. Fruit: June-July.

8. *Vitis semicordata*, Wall. Syn. *Vitis himalayana*, Brandis. Vern. *Lāderi* or *Lāduli*, G.—A large deciduous climber with stems up to 6 inches diameter and 100 feet high. Bark brown, very rough, deeply furrowed. Blaze 1 inch, coarsely fibrous, pink. Young shoots glabrous or pubescent. Tendrils branched, usually ending in adhesive disks. Leaves palmately trifoliate. Petiole up to 5 inches long. Terminal leaflet 3—6 inches long, ovate or obovate, base cuneate or rounded, tip long-acuminate, margin coarsely cuspidate-serrate; lateral leaflets very oblique, one side subcordate; dull green above, pale and somewhat glaucous or sometimes purplish-pink beneath, thin, membranous. Petiolules 0—2 inch long. Flowers small, yellowish-green, 4- or 5-merous, in terminal or leaf-opposed lax divaricate cymes up to 4 inches diameter, shorter than the leaves. Petals ending in a conical hood, spreading and soon reflexed. Fruit .2—3 inch diameter, purplish-black, subglobose. Seeds 1—4.

Occurs throughout the hills between 5,000 and 9,500 feet. Very common in oak, spruce and silver fir forests. Some plants have leaves which are pubescent on the nerves beneath, others are entirely glabrous, but it seems unnecessary to draw any distinction between the two varieties which are often found growing together. The leaves turn bright orange or red before falling. Flowers: May—July. Fruit: September—November.

9. *Vitis trifolia*, Linn. Syn. *V. carnos*a, Wall.—A climber with sometimes herbaceous sometimes distinctly woody (though soft and rather succulent) stems up to 2 inches diameter and 15 feet high. Bark rough with numerous small pale brown lenticels. Young shoots pubescent or villous. Tendrils slender, branched, ending in adhesive disks. Leaves pinnately 3-foliolate. Petiole 1—3·5 inches long. Leaflets usually 2—5 by 1·5-2·5 inches, the terminal usually elliptic or obovate, the lateral usually broadly ovate and often obliquely cordate at the base or cuneate, apex acute, coarsely crenate or irregularly dentate, clothed more or less on both surfaces with whitish pubescence. Petiolule of terminal leaflet up to 1 inch long, of the lateral 0—·2 inch long. Flowers ·25 inch diameter, 4-merous, in-lax, divaricate, long-peduncled, thinly hairy cymes 2-3·5 inches across. Petals green, not cohering at the apex, soon reflexed. Disk whitish. Fruit ·5—·7 inch diameter, depressed-globose, black. Seeds 2—4.

Occurs in the subhimalayan tract and outermost hill ranges up to 2,000 feet. It is apparently scarce. Flowers: May—July. Fruit: October—December.

10. *Vitis lanceolaria*, Roxb.—A large evergreen climber with stems up to 9 inches diameter and 60 feet high. Stems more or less flattened or compressed, often very considerably so. Bark pale brown, slightly rough with conspicuous raised lenticels but not corky or deeply furrowed. Blaze not fibrous, pink or white with yellow streaks, juice rather slimy and turning purplish-black on the blade of a knife. Tendrils simple, often stout. Twigs smooth, green, glabrous, with prominent lenticels. Leaves pedately or rarely digitately 5-foliolate, or sometimes trifoliolate by suppression, very rarely pedately 7-foliolate, glabrous. Petiole 2—7 inches long, terete or slightly flattened, the basal ·5—1 inch swollen. Terminal leaflet 5—8 by 2-3·5 inches, elliptic-oblong or narrowly obovate, abruptly acuminate, rather distantly crenate-serrate except towards the base, base acute, lateral nerves 7—10 pairs; the lowest pair somewhat oblique and about half the size of the terminal; all rather fleshy, dark and slightly glossy green above. Petiolule of terminal leaflet ·5—1·75 inches long. Stalk of lateral pedate branch up to 1 inch long. Flowers small, green, 4-merous, in sub-corymbose axillary puberulous cymes, the branches terminating in umbels. Fruit ·4—·6 inch diameter, globose. Seeds 1—4.

Occurs throughout the subhimalayan tract and outer hill ranges between 1,500 and 4,000 feet. Fairly common in ravines and along the banks of streams. Flowers: April. Fruit: March.

11. *Vitis capriolata*, Don.—A medium-sized evergreen glabrous climber with stems up to 1·5 inches diameter and 80 feet high, the upper branches often hanging in dense leafy festoons. The stems

develop numerous adventitious roots which are made more use of for the purpose of climbing than the tendrils. Tendrils 2—6 inches long, bifurcating once within a distance of 2 inches of the tip. Leaves pedately 5-foliolate. Petiole 1·25 inches long, grooved. Stipules persistent, triangular, 1·2 inch long. Terminal leaflet 2·3 times as long as the smallest lateral pair, 1·5—3 inches long, elliptic-lanceolate or obovate, acute; all leaflets crenate, the 6—13 pairs of arcuate secondary nerves terminating in points which are raised at an angle with the leaf-surface, midrib and lateral nerves distinctly pale above; the lowest pair of leaflets more rounded and with oblique base. Petiolule of terminal leaflet 1—4 inch long. Flowers small, pale green, 4- or 5-merous in few-branched glabrous umbelliform cymes 1—3 inches long terminating in umbels. Primary peduncle 25—1 inch long though often appearing longer owing to the suppression of leaves immediately below the inflorescence. Petals at once reflexed, with a small hollow horn at the tip. Fruit 3 inch diameter, globose, black. Seeds 1-2.

Occurs throughout the hills between 5,500 and 7,000 feet. Common in shady oak forest and moist ravines, where it is often found creeping over precipitous rocks. Flowers: June—September. Fruit: November.

12. *Vitis affine*, Gagnepain.—A slender evergreen climber with stems, which are scarcely woody, up to 20 feet high and 25 inch diameter. • Glabrous except the pedicels which bear scattered minute hairs when young. Not climbing by, and probably never producing, adventitious roots. Tendrils 4—7 inches long, bifurcating once within a distance of 2 inches of the tip. Leaves pedately 5-foliolate. Petiole 75—25 inches long, the basal half somewhat swollen. Stipules persistent, triangular, 15—2 inch long. Terminal leaflet twice the size of the lateral pairs, 2—4 by 5—1 inch, lanceolate, acuminate; all leaflets crenate, the 8—12 pairs of lateral nerves terminating in points which are raised at an angle with the leaf-surface, the midrib and lateral nerves not noticeably paler above; the lateral pairs broader; the lowest usually obliquely ovate. Petiolule of terminal leaflet 15—5 inch long. Flowers 15—2 inch diameter, greenish, 4-merous in few-branched minutely hairy umbelliform cymes 2—4 inches long terminating in umbels. Primary peduncle 75—3 inches long. Petals terminating in a reddish-brown hollow horn. Stamens minute. Fruit 3—5 inch diameter, globose, shining, black. Seeds 1-2, usually 1, 2 inch long, ovoid, sides deeply corrugated, with 3 prominent ridges on the back formed by 2 parallel depressions.

Occurs throughout the hills between 6,500 and 8,500 feet. Fairly common in dense shady forest on north aspects, frequently associated with *Quercus dilatata*. Flowers: May-June. Fruit: September. The identification of this species is by Mr. Gagnepain himself who has named many sheets in the herbarium at Dehra Dun. My description is based on my numbers 521, 633, 693, 833 and 1234.

13. *Vitis*, sp.—A small glabrous climber with stems up to 20 feet high and .5 inch diameter; not climbing by means of adventitious roots. Tendrils 4—6 inches long, bifurcating once within a distance of 2 inches of the tip. Leaves pedately 5-foliolate. Petiole 1.5—3 inches long, terete, the basal portion somewhat swollen. Stipules persistent, triangular, .1 inch long. Terminal leaflet 2-3 times as long as the smallest lateral pair, 3—6 inches long, elliptic-lanceolate or elliptic, acute or acuminate; all leaflets crenate, the 8—16 pairs of arcuate secondary nerves terminating in points which are raised at an angle with the leaf surface, the midrib and lateral nerves not noticeably paler above; the lowest pair of leaflets with oblique base. Petiolule of terminal leaflet .3—.8 inch long. Flowers small, pale green, 4-merous, in few-branched glabrous umbelliform cymes 1—3 inches long terminating in umbels. Primary peduncle .5—1.5 inches long, though often appearing longer owing to the suppression of leaves immediately below the inflorescence. Petals at once reflexed, with a small hollow horn at the tip. Fruit .3—.4 inch diameter, globose, black. Seeds 1—3, .25 inch long, ellipsoid, rugose all over with a single dorsal depression.

Occurs throughout the central and outer hill ranges between 3,500 and 6,000 feet. Fairly common. Flowers: September. Fruit: January-February. This plant has hitherto been confused with *V. capriolata*, Don. from which it is in my opinion quite distinct. My description is based on my numbers 576, 577, 1028 and 1203.

14. *Vitis obtecta*, Wall.—An evergreen climber creeping over the surface of the ground or climbing up the stems of trees to which it closely adheres by means of tendrils and numerous adventitious roots, the stem attaining 40 feet height and 1 inch diameter, but usually half this height. Tendrils consisting of a stout stalk .1—.25 inch long terminating in 5—9 palmately radiating simple spirally coiled branches .5—1.5 inches long which develop adhesive disks on contact. Leaves digitately 5-foliolate. Petiole 1.5—5 inches long, terete, pinkish, clothed with spreading pale hairs. Terminal leaflet elliptic, 2—4 by 1.25-2.25 inches with about 5—8 pairs of lateral nerves; the two lateral pairs usually very oblique; the lowest pair usually not exceeding half the size of the terminal leaflet; all distantly cuspidate-crenate, rather thick, usually hairy and dull green on both surfaces, sometimes quite glabrous even when young. Petiolule of terminal leaflet 0—.25 inch long. Flowers small, green, 4-merous, in few-branched pubescent cymes, the branches terminating in umbels. Fruit .3—.5 inch diameter, elliptic or globose, shining, black. Seeds 1—3.

Occurs throughout the hills between 4,500 and 7,000 feet. Common in shady forest and moist ravines especially in *banj* forest. Flowers: May. Fruit: October-November.

15. *Vitis Parkeri*, Gagnepain.—A large evergreen climber with stems up to 9 inches diameter and 80 feet high. Stems terete. Bark

reddish-brown, very rough and rather corky, furrowed and often deeply so. Blaze very fibrous, pink or white streaked with pink turning orange on exposure, juice very slimy and turning purplish-black on the blade of a knife. Tendrils simple, often stout and long. Twigs smooth, green, glabrous, without prominent lenticels. Leaves digitately 3—6-foliolate, never pedate. Petiole 4—8 inches long, terete, basal .5 inch swollen. Terminal leaflet 4—7 by 2.5—4 inches, elliptic, abruptly acuminate often caudate, lateral nerves excurrent in 3—5 short cuspidate teeth, base cuneate, glabrous, rather thick, dark somewhat shining green above, paler and shining beneath, lateral nerves 3—7 pairs, arcuate; lateral pairs of leaflets smaller. Petiolule of terminal leaflet .5—1.75 inches long, of the lateral shorter. Flowers small, 4-merous, in lax, rather slender, puberulous, subcorymbose, axillary cymes. Fruit .4— .8 inch long, oblong or ovoid, first reddish and finally black. Seeds 1—3, usually 1, ellipsoid, .3— .5 inch long with 6—10 shallow transverse furrows.

I first collected this vine in the Ramnagar Division where I found it fairly common in sal forest between 1,500 and 3,000 feet especially in moist ravines and on the banks of shady streams. On these specimens M. Gagnepain has named the vine *V. Parkeri*. It may however be doubted whether it is not the *V. campylocarpa* of Kurz, but the description of that author is very meagre and M. Gagnepain himself seems to have been in doubt as to what that species really was. *V. Parkeri* occurs throughout the sub-himalayan tract and outer hill ranges. Flowers: November-December. Fruit: April-May.

2. LEEA, Linn.

Small trees shrubs or herbs, erect and without tendrils. Leaves usually large with sheathing petiole, simple or usually pinnately decom-pound. Flowers small, in leaf-opposed or subterminal corymbose cymes. Calyx 5-lobed. Petals 5, connate at the base and adhering to the staminal tube, afterwards revolute, induplicate-valvate, hooded at the apex. Disk or staminal tube cylindric with 5 lobes, connate at the base with the ovary, furnished within with a toothed membranous fold. Stamens 5, inserted between the lobes of the disk. Ovary 3—6-celled; ovule 1 in each cell. Berry usually succulent and 3—6-seeded.

Flowers and inflorescence red. Leaflets not scabrous,
mostly sessile 1. *alata*.

Flowers green. Inflorescence not red. Leaflets scabrid
above, shortly stalked 2. *aspera*.

1. *Leea alata*, Edgew.—An erect stout perennial herb, the stems usually 1—3 feet high and dying back annually to a woody base. Leaves 1-pinnate, 3—7-foliolate. Leaf-rachis with 2 narrow wings above which sometimes expand towards the base of the petiole. Leaflets 6—12 by 1—3 inches, oblong or oblong-lanceolate, acute, base rounded or rhomboid, sessile or on petiolules up to .4 inch long, glabrous or nearly

so, with 8—15 pairs of secondary nerves and 3—6 serratures in the leaf-margin to each secondary nerve. Peduncles 3—8 inches long, pubescent. Flowers crowded, red, .15 inch diameter; the whole inflorescence reddish. Berries .3-.4 inch diameter, depressed-globose, reddish-purple.

This species seems to occur in the subhimalayan tract though there are no specimens from our area at Dehra Dun. There is however a sheet in the Kew Herbarium collected by Falconer and labelled Garhwal. Flowers: June-July. Fruit: October-November.

2. *Leea aspera*, Wall. Vern. *Kumāli*, Gen. *Kunwai*, R.—An erect deciduous herb or shrub, the stems usually 2-3 feet high, but attaining 10 feet high and 1.5 inches diameter. The larger stems perennial, scarcely woody and containing a large succulent pith; the smaller dying back to the ground, arching, ribbed. Bark smooth, reddish-brown. Leaves towards the ends of the shoots simply pinnate or with the lower pinnæ trifoliolate; lower leaves bipinnate. Petiole not winged. Leaflets 3—6 by 2-3 inches, ovate or elliptic-oblong, abruptly long-acuminate, base rounded or cordate, strongly often coarsely serrate, with 12—18 pairs of secondary nerves each supplying one or sometimes 2 teeth, upper surface scabrid with scattered pale hairs, lower surface pubescent on the nerves. Petiolules .2—.7 inch long, rather slender. Cymes bifurcated at the base, or with a peduncle up to 2 inches long, pubescent. Flowers .2 inch diameter, pale green. Berries .4 inch diameter, depressed-globose, slaty-green and finally blue-black. Seeds 5.

Occurs throughout the area between 1,000 and 5,000 feet. Very common, especially in *chir* forest. The leaves turn bright red and orange in the autumn. Flowers: June-July. Fruit: October-November.

XXVIII.—SAPINDACEÆ.

Trees, shrubs or rarely climbing herbs. Leaves alternate or opposite, usually compound; stipules caducous or 0. Flowers regular or zygomorphic, generally polygamous. Calyx 4-5-lobed or 4-5-sepalous, valvate or imbricate. Petals 4-5 or 0, free, equal or unequal, often bearded or bearing a scale at the base within. Disk usually distinct, annular or unilateral, sometimes of separate glands, rarely wanting in male flowers. Stamens 4—10, usually 8, inserted inside on or outside the disk; filaments usually free. Ovary entire, lobed or partite, sometimes excentric, 1—4-celled; style simple or divided; ovules 1-2, rarely more, in each cell. Fruit capsular or indehiscent, sometimes winged. Seeds sometimes arillate.

I.—Leaves opposite.

- | | | | | |
|---|-----|-----|-----|-----------------------|
| 1. Leaves pinnate | ... | ... | ... | 1. <i>Turpinia</i> . |
| 2. Leaves trifoliolate | ... | ... | ... | 2. <i>Staphylea</i> . |
| 3. Leaves simple, often palmately lobed | ... | ... | ... | 3. <i>Acer</i> . |
| 4. Leaves digitate | ... | ... | ... | 4. <i>Aesculus</i> . |

II.—Leaves alternate.

- | | | | | |
|-----------------------|-----|-----|-----|-------------------------|
| 1. Leaflets 2—4 pairs | ... | ... | ... | 5. <i>Schleichera</i> . |
| 2. Leaflets 5—8 pairs | ... | ... | ... | 6. <i>Sapindus</i> . |

1. TURPINIA, Vent.

Trees or shrubs. Leaves opposite, imparipinnate. Leaflets opposite, serrulate. Stipules interpetiolar, deciduous. Flowers small, hermaphrodite, regular, in terminal and axillary panicles. Calyx 5-partite, lobes imbricate. Petals 5, imbricate. Stamens 5, inserted outside the lobed or crenulate raised disk. Ovary sessile, 3-lobed and 3-celled; style long; stigmas 3; ovules 2 or more in each cell. Fruit indehiscent, subglobose, 3-celled.

***Turpinia nepalensis*, Wall.**—A small glabrous tree up to 4 feet girth and 25 feet high. Bark pale brown or whitish, rather deeply cracked, corky. Blaze 3—35 inch, pale orange-yellow mottled darker. Leaves 8—15 inches long, 3—7—usually 5-foliolate. Leaflets subequal, the terminal one 4—6 by 1.25—2 inches; all oblong or elliptic-oblong, caudate-acuminate, base cuneate acute, shallowly and evenly serrate, glabrous, dark rather glossy green above with pale midrib and 5—8 pairs of rather indistinct arcuate secondary nerves. Petiolule of terminal

leaflet .6—1.2 inches long, of the laterals .1—.5 inch long. Flowers under .1 inch diameter, white, in long-peduncled lax axillary panicles 6—9 inches long with rather slender opposite primary branches. Fruit .3 inch diameter, globose, somewhat laterally compressed, indistinctly 6-lobed, succulent, purplish. Seed 1.

Occurs in the central and inner ranges between 3,000 and 6,000 feet. Scarce, and rare in Garhwal. Prefers shady valleys. It is probably evergreen. Flowers: April-May. Fruit: October-November.

2. STAPHYLEA, *Linn.*

Shrubs or trees. Leaves opposite, stipulate, trifoliolate or pinnate. Inflorescence lateral and terminal. Flowers regular, hermaphrodite. Sepals 5, coloured, imbricate in bud. Petals 5, imbricate. Stamens 5, alternate with the petals, inserted below the edge of the lobed disk. Ovary of 2-3 distinct carpels more or less united by their inner angles; ovules 6—8 in each carpel. Fruit a membranous usually inflated capsule, dehiscent at the summit.

Staphylea Emodi, *Wall.* Vern. *Sablāta* or *Surkhi*, *NG.* *Kāris*, *RK.*—A deciduous shrub, usually 6—12 feet high but attaining 6 inches diameter and 20 feet high. Strong adventitious shoots are often formed near the base. Bark fairly smooth, pale grey. Blaze .2—.25 inch, pale yellow finely mottled with orange or reddish-brown. Adventitious shoots smooth, greenish-or purplish-brown with pale lenticels forming longitudinal streaks. Young shoots glabrous. Leaves 6—15 inches long, trifoliolate. Common petiole 2.5—6 inches long. Terminal leaflet 3—7 by 1.75—3.5 inches, the lateral a little smaller; all elliptic, acuminate, thin, membranous, sharply serrate, glabrous above, pale and more or less pubescent when young beneath, the lateral subsessile. Stalk of terminal leaflet .7—2.5 inches long. Flowers .4 inch long, white, in terminal usually drooping panicles 2—4 inches long. Pedicels .3—.6 inch long, glabrous. Fruit an inflated bladder-like capsule 2.3.5 inches long, 2-3-celled and lobed, dehiscing at the apex along the ventral suture. Seeds few, .3-.4 inch long, obovoid-globose, slightly compressed, brown, polished, with a large basal scar.

Occurs throughout the hills between 6,000 and 8,500 feet. Rather scarce or locally common and sometimes gregarious. Usually found in moist shady forest and cool ravines. Flowers: April-May. Fruit: October—December.

3. ACER, *Linn.* (*The Maples.*)

Trees or shrubs; buds with many scales, the outer shorter, coriaceous, the inner oblong, membranous, developing later. Leaves entire, palmately lobed or pinnately 3—5-foliolate. Flowers regular, in racemes

or corymbs. Calyx usually 5-lobed, the lobes imbricate, deciduous. Petals as many as the calyx-lobes or 0, erect, shortly clawed. Disk thick. Stamens usually 8, inserted on the disk. Ovary 2-rarely 3-lobed and-celled, laterally compressed; cells 2-ovuled; style bipartite. Fruit a double samara, indehiscent; wing large, membranous.

I.—Leaves undivided, margin entire or serrate.

- | | | |
|--|-------|-----------------------|
| 1. Leaves pale glaucous beneath. Petiole | ·7—2 | |
| inches long | ... | 1. <i>oblongum</i> . |
| 2. Leaves glossy green beneath. Petiole | ·2—·5 | |
| inch long | ... | 2. <i>lævigatum</i> . |

II.—Leaves 3—5-lobed, margin serrate or toothed.

- | | | |
|--------------------------------------|-------|------------------------|
| A. Leaves pale and glaucous beneath | ... | 3. <i>cæsum</i> . |
| B. Leaves green beneath. | | |
| 1. Leaves more than 6 inches across | ... | 4. <i>villosum</i> . |
| 2. Leaves less than 6 inches across. | | |
| (a) Racemes corymbose. Pedicels | ·3—·5 | |
| inch long | ... | 5. <i>acuminatum</i> . |
| (b) Racemes not corymbose. Pedicels | ·1—·3 | |
| inch long | ... | 6. <i>pectinatum</i> . |

III.—Leaves 5—7-lobed, margins entire	...	7. <i>pictum</i> .
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1. *Acer oblongum*, Wall. Vern. *Phandgao* or *Pharbanj*, NG. *Kirmōli*, SG. *Phatgal* or *Phatgab*, A.—A medium-sized or large evergreen or subdeciduous tree up to 8 feet girth and 80 feet high. Bark of young stems up to about 3 feet girth quite smooth, often with shallow vertical cracks; of old stems rough, pinkish-brown, exfoliating in loose thick woody strips. Blaze ·3—·6 inch, rather shortly fibrous, pink, the juice turning purplish on the blade of a knife. Young shoots glabrous. Leaves 2·5—6 by ·7—2·5 inches, elliptic-oblong or ovate-lanceolate, acuminate, entire, glaucous beneath, base usually rounded, 3-nerved, glabrous. Petiole ·7—2 inches long. Flowers ·3 inch diameter, pentamerous, in terminal pubescent corymbose panicles 1·5—3 inches long. Sepals greenish. Petals whitish. Fruit glabrous; wings about 1 inch long, diverging, contracted below, back nearly straight; nuts angular, clothed with white hairs within.

Occurs throughout the area between 1,500 and 7,000 feet. Common along the banks of streams and in moist shady forest especially of *banj* oak. I have measured a tree 14 feet girth and 110 feet high. The young immature foliage is often tinged bright pink. Flowers: February—April. Fruit: January—April.

2. *Acer lævigatum*, Wall.—A medium-sized subdeciduous tree up to 5 feet girth and 45 feet high. Bark pale ashy, whitish in patches, fairly smooth. Blaze ·5 inch, hard, only fibrous in the innermost layer, pale orange-yellow. Twigs bright green, usually purplish, smooth, terete. Young shoots glabrous. Leaves 4—8 by 1·2 inches, narrowly oblong-lanceolate, long-acuminate, distinctly serrate or subentire, undulate, thinly

coriaceous, glabrous or with tufts of hair in the nerve axils beneath, dark glossy green on both surfaces, rachis usually tinged pink on the under-surface, with 8—13 pairs of secondary nerves. Petiole .2—·5 inch long, pink. Flowers .2 inch diameter, pentamerous, in terminal glabrous panicles 2-3 inches long. Petals white. Fruit glabrous; wings .8—1 inch long, diverging, contracted below, back nearly straight; nuts smooth, glabrous within.

Occurs throughout the area between 5,500 and 6,500 feet. Rather scarce, usually in ravines in shady oak forest. Flowers: April. Fruit: October-November.

3. *Acer caesium*, Wall. Vern. *Kamia*, NG. *Khami* or *Kānjiöl*, RK. *Kānchula* and *Kānjula*, (the last two names are used indiscriminately in Garhwal for this and succeeding species of *Acer*).—A large deciduous tree up to 9 feet girth and 60 feet high. Bark pale grey, sometimes dark with silvery patches, rather rough exfoliating in irregular thin small scales. Blaze .35—·7 inch, very shortly fibrous, pinkish—or orange-brown, with numerous minute darker specks. Twigs and young shoots glabrous, with a thin glaucous film, not lenticellate. Leaves 4—8 by 4·5—11 inches, 5-lobed, the basal lobes often obscure, cordate, lobes acuminate, serrate, dull green above, pale and glaucous beneath, bearded in the axils of the nerves beneath, otherwise glabrous, basal nerves 5 prominent beneath. Petiole 3—10 inches long, terete, glabrous, often reddish. Flowers .2 inch diameter, pentamerous, yellowish-green, appearing with the young leaves, in terminal corymbose puberulous panicles 1·5-2·5 inches long. Fruit glabrate; wings 1·5—2 inches long, divergent, erect or sometimes overlapping, backs slightly curved; nuts dark brown, gibbous.

Occurs throughout the hills between 6,500 and 10,000 feet. Very common in forests of silver fir and *Quercus semecarpifolia*, and is somewhat gregarious. I have measured a tree 15 feet girth and 90 feet high. Flowers: March-April. Fruit: October-November.

4. *Acer villosum*, Wall. Vern. *Māndra*, NG. *Gobar-kami*, RK.—A small or medium-sized deciduous tree up to 7 feet girth and 60 feet high. Bark pale brown sometimes silvery, fairly smooth. Blaze .35—1 inch, soft, very shortly fibrous, pinkish-brown, the juice turning purple on the blade of a knife. Twigs and young shoots without a glaucous film, lenticellate, rusty-pubescent at first. Leaves 6—10 by 7—12 inches, usually 3-lobed but often more or less 5-lobed, margin distantly toothed, lobes acuminate, dull dark green above paler green beneath, glabrous, or with scattered hairs on the nerves above, densely clothed with soft pale tomentum beneath when young or glabrous except along the leaf margin and on the principal nerves and usually bearded in the leaf axils, base cordate 5-nerved, the secondary nerves paler and prominent on both surfaces. Petiole 2—10 inches long, terete, more or

less hairy. Flowers 2·3 inch diameter, pentamerous, yellowish-green, in simple or branched hairy racemes 2—4 inches long appearing with the leaves from lateral shoots which do not produce leaves. Fruit more or less villous even when ripe; wings 1·5—2 inches long, divergent or erect with the margins overlapping, backs usually curved; nuts brown.

Occurs throughout the hills between 7,000 and 9,000 feet. May be locally common but generally rather scarce. Chiefly found in ravines and on north aspects. The variety with leaves densely tomentose beneath has only been recorded from the main inner ranges and is apparently the true *A. villosum* of Wallich, whereas the commoner more glabrous form corresponds to *A. Thomsonii*, Miq. in Arch. Flowers: March-April. Fruit: October--November.

5. *Acer acuminatum*, Wall. Syn. *A. caudatum*, Wall, *ex parte*. Vern. *Rath-kāñchula*, NG. *Kamia* or *Kimia*, G and A.—A large deciduous shrub or small tree up to 3 feet girth and 30 feet high, often producing several stems from near the ground. Bark roughish, pale sometimes silvery brown, exfoliating in irregular thin scales. Blaze 25 inch, pale pinkish-brown with minute darker specks. Young stems and twigs quite smooth, dark green or purplish-red with scattered pale lenticels. Young shoots glabrous, usually red with a glaucous film. Leaves 2·5—5 inches long and broad, 5-lobed with the two outer lobes smaller or sometimes wanting, lobes caudate-acuminate, sharply and closely serrate usually simply sometimes doubly, minutely adpressed hairy on the main nerves when quite young, glabrous when mature except for tufts of hair in the axils of the 5 palmate basal nerves, base rounded or cordate. Petiole 2—4 inches long, pink or red, slender, puberulous. Flowers 2 inch diameter, greenish, in glabrous corymbose racemes 5—1·5 inches long which appear before or with the young leaves, the male on leafless, the bisexual on leafy side shoots. Pedicels 3—5 inch long, very slender. Sepals oblong, acute. Petals shorter than the sepals, oblanceolate, acute. Stamens much exserted. Fruit glabrous; wings 8—1·2 inches long, erect or divergent, backs straight or curved; nuts brown.

Occurs along the slopes of the main Himalayan range, but not on the outer ranges, between 8,000 and 10,500 feet. Common in silver fir and *karshu* forests. The leaves turn bright yellow before falling. Flowers: April-May. Fruit: October-November.

6. *Acer pectinatum*, Wall.—A deciduous tree. Young shoots glabrous. Leaves 2·5—4·5 inches long and broad, 3—5-lobed the two outer lobes when present only obscurely developed, lobes caudate-acuminate, sharply and closely doubly-serrate, glabrous above except for a tuft of hairs at its junction with the petiole, the nerves more or less clothed with short spreading hairs beneath and with tufts of hairs in the axils of the secondary nerves as well as of the 5 basal ones, otherwise

glabrous, base cordate. Petiole 1—3 inches long, pink or red, slender. Flowers .25 inch diameter, in simple terminal racemes (not corymbose) 1.5—3 inches long, appearing after the leaves. Rachis red, puberulous with tufts of hair at the bases of the pedicels. Pedicels .1—·3 inch long. Sepals obovate, obtuse, brownish-purple. Petals equal to the sepals, obovate, obtuse, yellowish-green. Stamens shorter than the petals. Fruit glabrous; wings .5—·8 inch long extended in a nearly horizontal line, backs slightly curved.

Has been collected at Dagiadhura by Mr. W. J. Lambert also on the Shumri ridge by Mr. J. H. Lyall, both places in East Almora. Its range appears to be about 9,000—10,500 feet. Flowers: May. Fruit: October.

7. *Acer pictum*, Thunb. Vern. *Gadh-pāpri*, G.—A small or medium-sized deciduous tree up to 6 feet girth and 70 feet high, usually producing several stems or many strong adventitious shoots from near the ground, old stems irregularly fluted and knotted towards the base. Bark pale grey or silvery-brown, fairly smooth, with shallow cracks. Blaze .5—·75 inch, soft, not fibrous, pinkish-brown. Young shoots glabrous with a thin glaucous film, not lenticellate. Adventitious shoots often dark green. Leaves 3-6 by 4-8 inches, 5—7-lobed, lobes acuminate, margins entire, base usually cordate, bearded in the axils of the nerves otherwise glabrous, glossy green on both surfaces especially beneath, base 5—7-nerved. Petiole 1—8 inches long, slender, terete, pink when young. Flowers .3 inch diameter, greenish-yellow, pentamerous, in terminal glabrous trichotomous panicles 2—4 inches long on short leafy shoots appearing with the young leaves. Fruit glabrous; wings 1—1.3 inches long, divaricate, backs curved outwards, pink when young; nuts thin, compressed.

Occurs throughout the hills between 6,000 and 9,000 feet. Very common in oak forest, especially on north aspects. I have measured a tree in Garhwal 9.5 feet girth and 40 feet high. The leaves usually turn yellow before falling. Flowers: March—May. Fruit: December—February.

4. *AESCULUS*, Linn. (*The Horse-chestnuts*.)

Trees with large scaly buds. Leaves opposite, digitate, exstipulate. Flowers in a terminal thyrsus, polygamous, fertile ones generally near the base of the thyrsus-branches. Calyx 5-lobed, campanulate or tubular; lobes more or less unequal. Petals 5, or the fifth abortive, unequal. Disk lobed. Stamens 6—8, outer whorl of 5, inner of 1—3. Ovary 3-celled; style slender, undivided; ovules 2 in each cell. Fruit a leathery 1—3-celled and-seeded capsule, loculicidally 2-3-valved.

Aesculus indica, Colebr. Vern. *Pāngar*, Gen. Eng. Himalayan Horse-chestnut.—A large deciduous tree up to 12 feet girth and 120 feet

high. Bark of young stems up to about 3 feet girth quite smooth, of old stems rough exfoliating in thick woody plates which usually take the form of long strips 1-2 inches wide and these remain for long attached by their upper extremities only. Old bark often characterised by wavy horizontal lines of lenticels. Blaze .35—.5 inch, soft not fibrous, pinkish rapidly turning dark orange-brown on exposure. Petiole 4—6 inches long. Leaflets 5—9, 6—10 by 2-3.5 inches, the outer smaller, oblong-lanceolate or oblong-oblancheolate, acuminate, sharply serrate, glabrous, narrowed at the base. Petiolules .2—1 inch long. Flowers 1 inch long, in numerous, small, pubescent cymes arranged in terminal, erect, narrow-pyramidal panicles 12—15 inches long. Petals clawed, white and yellow, base often streaked with red, 2 petals narrower than the others. Fruit a capsule 1-2 inches long, ovoid, not echinate, containing 1—3 but usually 1 seed. Seeds 1-2 inches diameter, rounded, depressed, dark brown, shining, scored irregularly with linear furrows.

Occurs in an indigenous state throughout the hills between 5,000 and 9,500 feet and is also frequently planted. Common and sometimes gregarious on the inner ranges. I have measured a sound tree in North Garhwal 18 feet girth and 145 feet high; and I have measured a hollow tree of 20 feet girth. Old stems are often irregularly fluted at the base. Flowers : May-June. Fruit : September—November.

5. SCHLEICHERA, Willd.

Trees. Leaves alternate, paripinnate, exstipulate. Flowers regular, polygamo-dioecious, small, fascicled in slender racemes or panicles. Calyx small, cupular; lobes 4—6. Petals 0. Disk flat, undulate on the margin. Stamens 5—8, inserted within the disk. Ovary ovoid, narrowed to the rigid style, 3-celled; stigma 3-4-lobed; ovules solitary. Fruit dry, crustaceous, indehiscent. Seeds with a fleshy aril.

Schleichera trijuga, Willd. Vern. *Kusm*, Gen.—A small or medium-sized deciduous or subdeciduous tree up to 9 feet girth and 60 feet high with short bole and dense spreading crown, the base of the stem often irregularly fluted. Bark pale brown, fairly smooth, thinly mealy-corky outside, exfoliating in irregular woody scales. Blaze .4—.6 inch, hard, not fibrous, pinkish, stippled with pale orange sclerotic tissue. Leaves 8—16 inches long. Leaflets 2—4 pairs, the lowest pair usually about one-third the size of the terminal, the terminal 4—9 by 1.5—4 inches, elliptic, entire, glabrous, apex usually rounded, subsessile. Flowers greenish-yellow, fascicled in spike-like lateral racemes 3—5 inches long, simple or often paniced in the male, appearing with the new foliage which is coloured

a fresh green or deep red. Fruit 1—1.5 inches long, ovoid, 1-2-seeded. Seeds .6 inch long, smooth, compressed, brown.

Occurs throughout the subhimalayan tract and central and outer hill ranges up to 3,000 feet. A fairly common associate of *sal*. Flowers: March-April. Fruit: July-August.

6. SAPINDUS, *Linn.*

Trees or shrubs. Leaves alternate, paripinnate; leaflets entire; stipules 0. Flowers regular, polygamous, in panicles. Sepals 5, unequal, in 2 series, much imbricate. Petals 4-5. Disk annular, lobed. Stamens usually 8, inserted within the disk; filaments free. Ovary entire or 2-4-lobed, 2-4-celled; stigma 2-4-lobed; ovule solitary. Fruit fleshy or coriaceous, of 1-3 indehiscent drupes; drupes with fibrous pericarp, brittle when dry. Seeds with a very hard outer integument.

Sapindus Mukorossi, *Gaertn.* Syn. *S. detergens*, *Roxb.* Vern. *Ritha*, Gen. Eng. The Soap-nut tree.—A small or medium-sized deciduous tree up to 6 feet girth and 50 feet high. Bark dark or pale grey, somewhat rough, exfoliating in irregular woody scales. Blaze .3—5 inch, hard, not fibrous, pale orange-brown. Leaves 9-20 inches long. Leaflets 5-8 pairs, opposite or alternate, 3.5-7 by 1-2 inches, lanceolate, acuminate, glabrous, often slightly falcate or oblique, with 15-20 pairs of rather indistinct secondary nerves and others between. Petiolules 1-2 inch long. Flowers .2 inch diameter, white or purple, subsessile, very numerous, mostly bisexual, in large terminal pubescent pyramidal panicles. Fruit of 1-3 distinct, indehiscent carpels, .7-1 inch diameter, smooth, pale brown, globose, wrinkled before falling. As a rule only one carpel develops and the undeveloped ovaries persist as excrescences at the base of the one which has developed. Seeds solitary, .4-5 inch diameter, globose, black, loosely contained in the fleshy pericarp.

Occurs throughout the area up to 5,000 feet. Frequently planted and often self-sown; but probably not indigenous. The leaves turn yellow (not brown as in the *Tun*) before falling. Flowers: May-June. Fruit: October-February.

XXIX.—SABIACEÆ.

Trees or erect or climbing shrubs. Leaves alternate, simple or compound, stipules 0. Flowers small, hermaphrodite or polygamous, usually paniced. Calyx 4-5-partite, imbricate. Petals 3—5, equal or unequal, opposite to or alternate with the sepals, valvate or imbricate. Disk usually small, annular. Stamens 4-5, opposite to the petals, inserted at the base of or on the disk; all perfect or 2 only. Ovary 2-3-celled, compressed or 2-3-lobed; styles 2-3, free or connate or 0; ovules 1-2 in each cell. Fruit of 1-2 dry or fleshy drupes.

Climbing shrubs. Petals equal. Stamens all fertile ... 1. *Sabia*.

Erect trees or shrubs. Petals unequal. Stamens 2
fertile, 3 sterile ... 2. *Meliosma*.

1. SABIA, *Colebr.*

Shrubs, sarmentose or climbing. Leaves simple or entire. Flowers usually hermaphrodite, axillary and solitary or in axillary simple or paniced cymes; the bracts, sepals, petals and stamens all opposite. Calyx 4-5-partite. Petals 4-5. Disk 4-5-lobed. Stamens 4-5, all perfect. Carpels 2, rarely 3, very slightly connate; styles 2; ovules 2 in each carpel. Ripe fruit of 1-2 dry or drupaceous carpels. Seeds reniform.

Peduncles 1-flowered. Leaves 2—4 inches long ... 1. *campanulata*.

Peduncles 3—5-flowered. Leaves 1.5—3 inches long ... 2. *purpurea*.

Flowers in many-flowered panicles. Leaves 5—10 inches
long ... 3. *paniculata*.

1. *Sabia campanulata*, Wall. Vern. *Lohāri*, RK.—A deciduous dextrorse climber with stems up to 25 feet high and 1 inch diameter. Bark slightly rough, exfoliating in thin papery pieces. Branches smooth, green. Young shoots glabrous. Leaves 2—4 by 5—1.5 inches, elliptic or oblong-lanceolate, entire, acuminate, thin, membranous. Petiole 2—6 inch long. Flowers 3—4 inch diameter, purplish-red or greenish-purple, axillary, usually solitary, appearing before or with the new leaves. Peduncles 5—1 inch long, all curving downwards. Fruit 3—4 inch diameter, first white then turquoise-blue, 1-2-lobed and-seeded, somewhat succulent on a subclavate peduncle 1-2 inches long.

Occurs throughout the hills between 6,000 and 9,000 feet. Common in shady forest on north aspects. Flowers: March-April. Fruit: May—July.

2. *Sabia purpurea*, Hook. f. and T.—A climber. Leaves 1·5—3 by ½—1 inch, oblong or ovate-oblong, acuminate, base rounded, entire, puberulous when young, glabrous when mature, nerves oblique uniting far within the margin. Flowers ½ inch diameter, purplish, in 3—5-flowered axillary glabrous cymes. Peduncles slender, ½—1 inch long. Sepals ovate, subacute.

Has been collected by Mr. W. J. Lambert from Kanara Talla in Askot, East Almora, where it is recorded as occurring between 3,500 and 5,000 feet. The fruit is said to resemble that of *S. campanulata*. Flowers: March.

3. *Sabia paniculata*, Edgew.—An evergreen dextrorse climber with widely spreading stems up to 30 feet high and 2 inches diameter. Bark smooth, dark brown. Blaze ½—¾ inch, hard, not fibrous, orange-yellow or pinkish-brown with narrow streaks of sclerotic tissue. Twigs smooth, bright green. Young shoots puberulous. Leaves 5—10 by 1·5—3·5 inches, elliptic or oblong-lanceolate, acute or shortly acuminate, base rounded or acute, entire, rather coriaceous, dark green and shining above, pale beneath, more or less hairy on the nerves when young, glabrous or nearly so when mature, with about 4—7 pairs of arching secondary nerves and others between, prominent beneath. Petiole ¼—1·5 inches long, stout. Flowers ¾ inch diameter, yellowish-green, sweet-scented, in hairy axillary sometimes leaf-bearing panicles 3—10 inches long. Rachis and branches pink. Fruit ¾ inch diameter, orbicular, compressed, turquoise-blue, succulent. Seeds solitary, brown.

Occurs in the subhimalayan tract between 1,000 and 3,000 feet. Appears to be generally scarce, but is common in certain shady ravines in the Ramnagar Division. It is found bordering streams in shady ravines or in swampy ground. When growing in swampy localities the stem sometimes produces from near the ground long usually unbranched and leafless shoots which incline downwards till they reach the ground-surface along which they run for a considerable distance sending out adventitious roots at intervals. Flowers: January—March.

2. MELIOSMA, Blume.

Trees or shrubs. Leaves simple or pinnate. Flowers small, irregular, usually hermaphrodite, in panicles. Sepals and their bracteoles 5—9, persistent, forming an uninterrupted spiral round the petals. Petals 5, the two innermost often scale-like. Stamens 5, the 3 opposite to the outer petals reduced to staminodes, the inner 2 more or less adnate at the base to the inner petals. Disk toothed. Ovary 2-rarely 3-celled, contracted into a simple or bifid style. Fruit a small obliquely globose drupe; stone crustaceous.

I.—Leaves simple.

- | | | |
|---|-----|----------------------------|
| 1. Leaves obovate; lateral nerves straight; teeth numerous, close | ... | 1. <i>dilleniaefolia</i> . |
| 2. Leaves oblanceolate; lateral nerves curved; teeth few, distant | ... | 2. <i>pungens</i> . |
| II.—Leaves pinnate | ... | 3. <i>Wallichii</i> . |

1. *Meliosma dillenizæfolia*, Walp. Vern. *Gulpha* or *Gōguna*, NG. *Gweb*, NG and RK.—A deciduous shrub 10—15 feet high or sometimes a small tree up to 3 feet girth and 35 feet high. Bark pale brown, fairly smooth, with conspicuous raised circular lenticels. Blaze .2—35 inch, soft, rather fibrous, pink turning orange-yellow on exposure. Young shoots rusty-hairy. Leaves 4—12 by 2—5 inches, elliptic-obovate, shortly acuminate, cuspidate-serrate, membranous, scabrid above when young, rusty-pubescent on the nerves and pale beneath, lateral nerves 15—20 pairs, straight, parallel. Petiole .5—1 inch long, rusty-hairy. Flowers .1 inch diameter, polygamous, white, very numerous, in terminal panicles 6—12 inches long, the lower branches often axillary. Drupe .2 inch diameter, globose, dark reddish-brown, eventually turning black (?), containing a single black rugose seed surrounded by pulp.

Occurs throughout the hills between 6,500 and 9,000 feet. Common in moderately dense forest. Flowers: May-June. Fruit: September.

2. *Meliosma pungens*, Walp. Vern. *Gōgsha*, Gen. *Gōgua* or *Gugua*, NG and RK. *Bhumis*, NG.—A medium-sized evergreen tree up to 7 feet girth and 50 feet high. Bark pale ashy, fairly smooth, with a thin outer corky layer. Blaze .5—75 inch, pink finely net-veined darker, the whole rapidly turning deep orange on exposure. Young shoots rusty-pubescent. Leaves 5—8 by 1-2 inches, oblanceolate, long-acuminate, coarsely and rather distantly cuspidate-serrate, rarely entire, firm, coriaceous, with fine adpressed hairs above when young, paler and glabrous or slightly hairy on the nerves beneath; lateral nerves about 8—10 pairs, arching. Petioles .2—7 inch long, rusty-pubescent and swollen at the base. Flowers .1-2 inch diameter, white, sweet-scented, polygamous, very numerous, in large terminal and axillary stiff erect panicles 4—10 inches long. Pedicels very short. Drupe .2 inch diameter, globose, black. Seeds solitary, rugose.

Occurs throughout the hills between 4,000 and 8,000 feet. Common in shady oak forest, especially *banj*. I have measured a tree 10 feet girth and 95 feet high in North Garhwal. Flowers: April—June. Fruit: October-November.

3. *Meliosma Wallichii*, Planch.—A medium-sized tree. Bark pale, whitish, smooth. Twigs densely rusty-tomentose. Leaves 7—16 inches long, imparipinnate, the rachis densely rusty-tomentose. Leaflets 9—13, increasing in size upwards, terminal one 3—6 by 1-2 inches, oblanceolate, the lower pairs usually oblong or elliptic-oblong, the lowest often much smaller and ovate or elliptic; all abruptly acuminate, base rounded or acute with shallow spinulose teeth in the upper half or sometimes entire, more or less hairy on the nerves above and dark green when mature, densely rusty-tomentose beneath, with about 7—12 pairs of secondary nerves and smaller ones between.

Petiolules of lateral leaflets 1·2 inch long. Flowers ·05 inch diameter, greenish, very numerous, in terminal, densely rusty-tomentose, much-branched, pyramidal panicles 6—12 inches long, the lower branches often in the axils of leaves. Pedicels very short. Drupe ·15 inch diameter, globose.

This species is reported to occur in both the Central and East Almora Divisions between 6,000 and 8,000 feet. It was seen by Mr. W. J. Lambert at Namik, Liti and Loharkhet and specimens were also collected by him. Flowers: June-July.

XXX.—ANACARDIACEÆ.

Trees or shrubs, usually with acrid or resinous juice. Leaves alternate or rarely opposite, simple or compound, exstipulate. Flowers small, regular, hermaphrodite polygamous or unisexual, often paniced. Calyx of 3—5 sepals, sometimes accrescent, sometimes spathaceous. Petals 3—5, alternate with the sepals, free, rarely 0, imbricate or valvate. Disk cupular or annular, rarely obsolete. Stamens as many as the petals, rarely twice as many, inserted under or on the disk. Ovary superior, rarely half inferior, 1-or 2—6-celled, rudimentary or 2-3-fid in the male, sometimes of 5-6 free carpels; styles usually combined; ovules solitary. Fruit a 1—5-celled, 1—5-seeded drupe; the stone sometimes dehiscent.

I.—Leaves simple.

- | | | | |
|-------------------------------------|-----|-----|------------------------|
| A. Fruit .2 inch long, dry | ... | ... | 1. <i>Rhus</i> . |
| B. Fruit larger, usually succulent. | | | |
| 1. Stamen 1 perfect | ... | ... | 2. <i>Mangifera</i> . |
| 2. Stamens 5 | ... | ... | 3. <i>Semecarpus</i> . |
| 3. Stamens 10 | ... | ... | 4. <i>Buchanania</i> . |

II.—Leaves trifoliolate or pinnate.

- | | | | |
|---|-----|------------------|----------------------|
| A. Petals 0 | ... | ... | 5. <i>Pistacia</i> . |
| B. Petals present. | | | |
| 1. Fruit not exceeding .4 inch long, dry... | | I. <i>Rhus</i> . | |
| 2. Fruit .5 inch long or more, succulent. | | | |
| (a) Leaflets without an intramarginal vein | ... | ... | 6. <i>Lannea</i> . |
| (b) Leaflets with an intramarginal vein | ... | ... | 7. <i>Spondias</i> . |

1. RHUS, Linn.

Trees or shrubs, often with acrid juice. Leaves alternate, simple trifoliolate or pinnate. Flowers small, polygamous, in panicles. Calyx small, 5-partite; lobes persistent, imbricate. Petals 5, imbricate. Disk cupular, lobed. Stamens 5, inserted below the disk. Ovary sessile, 1-celled; styles 3, free or connate; stigmas simple or capitate. Fruit a small dry compressed drupe; stone coriaceous or bony.

- | | | | |
|-----------------------------------|-----|-----|-------------------------|
| I.—Leaves simple | ... | ... | 1. <i>Cotinus</i> . |
| II.—Leaves trifoliolate | ... | ... | 2. <i>parviflora</i> . |
| III.—Leaves pinnate. | | | |
| A. Leaflets toothed | ... | ... | 3. <i>semialata</i> . |
| B. Leaflets usually quite entire. | | | |
| 1. Panicles terminal | ... | ... | 4. <i>punjabensis</i> . |
| 2. Panicles axillary. | | | |
| (a) Leaflets tomentose beneath | ... | ... | 5. <i>Wallichii</i> . |
| (b) Leaflets glabrous | ... | ... | 6. <i>acuminata</i> . |

1. *Rhus Cotinus*, Linn. Vern. *Jal-tunga*, G. *Chaniāt*, NG. *Chariānt*, RK.—A deciduous shrub or occasionally a small tree up to 5 feet girth and 20 feet high. Bark dark reddish-brown, rough, exfoliating in irregular small scales. Blaze .25—.35 inch, pink. Leaves simple, 2—4 inches long, elliptic, obovate or suborbicular, entire, glabrescent above, usually more or less tomentose beneath, with 8—14 pairs of parallel nerves branched within the margin. Petioles .8—2.5 inches long. Flowers .15 inch diameter, yellowish in terminal tomentose panicles 4—10 inches long. Pedicels slender, .1—2 inch long. Fertile flowers few, pedicels of the sterile flowers elongated after flowering and becoming densely covered with long grey silky hairs, forming a lax panicle with slender feathery branches usually tinged pink. Drupes .2 inch long, hairy, obliquely obovate.

Occurs throughout the hills between 3,000 and 7,000 feet. Fairly common in open forest, often associated with *bani* or *chir*. Young shoots, stalk of inflorescence and petioles of immature leaves bright pink. Flowers: April—June.

2. *Rhus parviflora*, Roxb. Vern. *Tunga* or *Tungla*, G. *Tang*, A.—An evergreen or subdeciduous shrub usually 4—8 feet high but attaining 3 feet girth and 15 feet high. Bark dark brown, roughish, exfoliating in small woody scales. Blaze .3—3.5 inch, pink or red. Twigs pale reddish-brown, rusty-tomentose. Leaves trifoliate. Petiole 1—2 inches long, tomentose. Leaflets 1—5 by .6—3 inches, the terminal much the largest, obovate, the basal portion entire and cuneately attenuate, the upper coarsely and irregularly crenate, rather thick, hairy on the nerves especially beneath; the lateral relatively broader and more rounded at the base, sessile. Flowers less than .1 inch diameter, yellowish-green, in terminal panicles 4—8 inches long, the lower branches axillary. Pedicels minute. Drupes .2 inch long, ovoid, brown, glabrous, shining.

Occurs throughout the hills between 3,000 and 7,000 feet. Very common and often gregarious in open *chir* forest or in secondary scrub forest. Flowers: May—June. Fruit: October—November.

3. *Rhus semialata*, Murray. Vern. *Dasmila*, *Dhāmila*, *Damp'hēla*, NG. *Dharmil*, RK.—A small deciduous tree up to 3 feet girth and 35 feet high. Bark smooth or slightly rough. Blaze .3—.5 inch, scarcely fibrous, pinkish mottled with orange-brown, exuding an orange-yellow acrid juice. Twigs lenticellate. Young shoots green with rusty pubescence. Leaves pinnate, 12—24 inches long, rachis usually with a narrow green wing between the last 3 pairs of leaflets, sometimes absent. Leaflets 7—15, the lateral opposite and sessile, the terminal leaflet 4.5—7 by 2—3 inches, the lowest pair usually 2—3.5 inches long; all oblong or ovate, acuminate, rather regularly and coarsely dentate or crenate, pubescent on the nerves above, tomentose beneath,

dull dark green above, very pale beneath, the terminal leaflet on a marginate petiole. Flowers 1½ inch diameter, scented, very numerous, in erect, terminal, broadly-pyramidal, tomentose panicles 6—15 inches long. Pedicels minute. Petals white. Disk yellow. Drupes 1½—2 inch diameter, compressed, globose, densely clothed with purplish-red pubescence and partly enveloped before ripening in a slimy white exudation with an acid taste, becoming dry when ripe and containing one pale brown seed.

Occurs throughout the hills between 3,000 and 7,000 feet. Common in blue pine, *banj* and *chir* forests with a tendency to occur in gregarious patches. The leaves turn shades of bright orange and red before falling. Flowers: July—September. Fruit: November.

4. *Rhus punjabensis*, Stewart. Vern. *Dasmila*, *Amlāra*, *Almora* or *Tituri*, NG.—A medium-sized deciduous tree up to 7½ feet girth and 50 feet high. Bark dark brown or blackish, rough, exfoliating in rounded woody scales 1-2 inches across. Blaze 4—1 inch, white inside, pink outside, exuding a thick creamy juice. Young shoots pubescent. Leaves pinnate, 12—18 inches long; rachis tomentose often slightly winged between the last and penultimate pairs of leaflets. Leaflets 9—15, the lateral opposite and sessile or nearly so; the terminal leaflet 4—6 by 1½—2 inches, the lowest pair usually 3-4 inches long; all ovate-oblong or lanceolate, acuminate, entire or with a few irregular teeth, slightly hairy on the nerves above, pubescent or sometimes tomentose beneath. Flowers 1 inch diameter, numerous, in erect terminal pyramidal pubescent panicles 5—10 inches long. Pedicels short. Calyx green. Corolla pale greenish or yellow. Anthers red. Drupes 1½—2 inch diameter, compressed, rounded, densely clothed with purplish-red pubescence, with one pale brown seed loosely contained within the dry pericarp.

Occurs on the inner hill ranges between 6,000 and 9,000 feet. Commonly associated with *Aesculus*, *Juglans regia*, *Ulmus* etc., in mixed deciduous forest. I have measured a tree 10 feet girth and 60 feet high. The leaves turn shades of bright orange and red before falling. Flowers: June-July. Fruit: October-November.

5. *Rhus Wallichii*, Hook. f. Vern. *Konki*, G.—A small deciduous tree up to 3 feet girth and 25 feet high. Bark dark brown, rough, rather deeply fissured, exfoliating in irregular hard woody scales. Blaze 3½—5 inch, rather hard, pale yellow streaked with pink or pale orange, exuding a yellow or black juice. Branches smooth, ashy. Young shoots clothed with silky brown tomentum. Leaves pinnate, 12—24 inches long; rachis tomentose, not winged. Leaflets 5—9, rarely 11, the lateral opposite, the terminal one 4½—9 by 1.75—4 inches, the lowest pair usually 2½—4½ inches long; all elliptic or oblong, subcoriaceous, entire, shortly acuminate, pubescent and dark green with pale midrib above, pale and softly hairy beneath, with 15—

25 pairs of parallel lateral nerves impressed above and prominent beneath. Petiolule of lateral leaflets .05—.2 inch long. Flowers .1-.2 inch diameter, pale greenish-yellow, faintly scented, subsessile, in dense stiff erect axillary tomentose panicles 4—12 inches long. Drupes .3— .35 inch diameter, globose, green, pubescent; exocarp dehiscent from the apex forming stellately spreading segments which are united by their bases and form a support to the stone; mesocarp thick, white, waxy; endocarp bony.

Occurs throughout the hills between 3,500 and 8,000 feet. Fairly common in open situations especially on rocky southern aspects, sometimes wedged in precipitous rocks. The corrosive juice is popularly supposed to blister the skin, but I have not found this to be the case. Flowers: May—July. Fruit: September—October.

6. *Rhus acuminata*, DC.—A medium-sized deciduous tree up to 6 feet girth and 40 feet high. Bark dark reddish-brown, rough, exfoliating in small irregular woody scales. Blaze .4—.75 inch, rather fibrous, white with a few orange streaks. Young shoots smooth, glabrous and covered with a thin pale waxy bloom. Leaves pinnate, 9—17 inches long; rachis glabrous, not winged. Leaflets 7—13, the lateral opposite, 2.5—5 by 1.25—2 inches, oblong or oblong-lanceolate, the basal pair often ovate, acuminate, base rounded or cuneate, entire, glabrous, rather glossy above, pale and glaucescent beneath, with 15—25 pairs of nearly straight and parallel secondary nerves and other shorter ones between. Petiolules of lateral leaflets .1-.2 inch long. Flowers .15 inch diameter in slender, rather lax, axillary, minutely pubescent panicles 4—6 inches long. Pedicels .05—.1 inch long. Drupes .4 inch diameter, obliquely globose and flattened, dry, wrinkled, greenish, glabrous.

Occurs on the inner and main Himalayan ranges in North Garhwal between 4,000 and 6,500 feet. Rather scarce. The leaves turn shades of bright orange and red before falling. I am doubtful whether this tree should be regarded as specifically different from *R. succedanea*, Linn. In the latter the principal secondary nerves are less numerous and are somewhat arched, whilst the inflorescence is also as a rule much longer. *R. succedanea* is found west of the Ganges, but has not yet to my knowledge been recorded from our area.

2. MANGIFERA, Linn.

Trees. Leaves alternate, simple, entire. Flowers polygamous, in terminal panicles; pedicels jointed. Calyx 4-5-partite; segments imbricate. Petals 4-5, free or adnate to the disk, imbricate. Disk fleshy, 4-5-lobed. Stamens 1—5, 1 sometimes 2 fertile, the others sterile. Ovary sessile, 1-celled, oblique. Fruit a large fleshy resinous drupe with a compressed fibrous stone.

***Mangifera indica*, Linn.** Vern. Am. Eng. Mango.—A large evergreen tree, glabrous except the inflorescence. Bark dark brown, rough, with large scattered raised lenticels. Blaze .5—.75 inch, fibrous, pale orange to orange-brown sometimes streaked with yellow towards

the exterior. Leaves 5—12 by 1·5—3·5 inches, oblong or oblong-lanceolate, coriaceous, shining, entire, the margin often undulate, base acute, with 20—30 pairs of parallel secondary nerves. Petiole 7—2·5 inches long, swollen at the base. Flowers about 1·5 inch diameter, yellowish-green, in terminal pubescent panicles longer than the leaves. Drupe 3-4 inches long with a large stone surrounded by a succulent mesocarp and thin epicarp.

Occurs wild, and is apparently indigenous, in shady moist ravines in the outer hills up to 3,000 feet. It is also abundantly planted throughout the area up to 3,000 feet. Flowers: March-April. Fruit: June-July.

3. SEMECARPUS, *Linn. f.*

Trees. Leaves alternate, simple, entire. Flowers polygamous or dioecious, in panicles. Calyx usually 5-, sometimes 3-lobed. Petals 5, rarely 3, imbricate. Disk broad, annular. Stamens inserted below the disk. Ovary in male flowers rudimentary or 0, in female or bisexual flowers superior, 1-celled; styles 3. Fruit an oblique drupe seated on a fleshy receptacle formed of the accrescent disk and calyx-base; pericarp full of acrid resin-glands.

Semecarpus Anacardium, *Linn.* Vern. *Bhilāwa* or *Bhilāo*, Gen. *Bhalao*, R and L. Eng. The marking-nut tree.—A small or medium-sized deciduous tree up to 7 feet girth and 70 feet high. Bark dark brown often with silvery-brown patches, fairly smooth, exfoliating in irregular thin soft scales. Young shoots tomentose. Leaves 7—18 by 4—8 inches, crowded at the ends of the branches, obovate-oblong, rounded at the apex, sometimes shortly auricled at the base, entire, coriaceous, glabrous above when mature, ashy-grey and more or less pubescent beneath, dull green above, with 15—25 pairs of prominent secondary nerves. Petiole 5—2 inches long, stout. Flowers 2·3 inch diameter, greenish-yellow, polygamous or dioecious, subsessile, in fascicles arranged in stout pubescent terminal panicles 5—15 inches long. Fruit an obliquely ovoid black drupe about 1 inch long seated on a bright orange-coloured fleshy receptacle.

Occurs throughout the subhimalayan tract and outer ranges of hills up to 4,500 feet. Very common in *sal* forest. The leaves usually turn bright yellow before falling. Flowers: June—September. Fruit: February-March.

4. BUCHANANIA, *Spreng.*

Trees. Leaves alternate, simple, entire. Flowers white, hermaphrodite, in branched panicles. Calyx 3—5-toothed, persistent, imbricate. Petals 4-5, imbricate. Disk 5-lobed. Stamens 8—10, inserted at the base of the disk. Ovary of 5-6 free carpels, one fertile, the rest imperfect; style short; stigma truncate. Fruit a small slightly fleshy drupe; stone crustaceous or bony, 2-valved.

Buchanania latifolia, Roxb. Vern. *Kath-bhilāwa*, G, L and R. *Muria* or *Mairia*, EA and H. *Piāl* or *Purāl*, L and R.—A small or medium-sized tree up to 5 feet girth and 60 feet high, nearly evergreen. Bark blackish, often tinged blue with fungus, rough, regularly split up by shallow reticulate cracks into rounded woody scales 5 inch across or less. Blaze 5—8 inch, shortly coarse-fibred, a bright deep reddish, the juice turning purple on the blade of a knife. Young shoots clothed with silky hairs. Leaves 6—10 by 2—3.5 inches, oblong or elliptic-oblong, entire, obtuse at both ends, coriaceous, hard, glabrescent above, more or less villous beneath, lateral nerves 15—20 pairs. Petiole 2—7 inch long, stout, hairy. Flowers 2—2.5 inch diameter, greenish-white, bisexual, sessile, in stout, erect, terminal and axillary, densely rusty-hairy panicles 2—7 inches long. Drupes 4—5 inch diameter, globose, black.

Occurs throughout the subhimalayan tract and the central and outer ranges up to 3,500 feet. Very common in sal forest. Flowers: March-April. Fruit: May-June.

5. *PISTACIA*, Linn.

Trees or shrubs. Leaves alternate, pinnate or trifoliate. Flowers dioecious, in axillary racemes or panicles. Calyx 3—5-fid in male flowers, with 3-4 sepals in the female. Corolla 0. Stamens 3—7 in the male. Ovary sessile, 1-celled; style 3-fid; stigmas-capitate. Drupe dry; stone bony.

Pistacia integerrima, Stewart. Vern. *Kakra*, Gen. *Kākar*, SG. *Kakri*, A.—A medium-sized deciduous tree up to 9 feet girth and 70 feet high, usually with short bole and spreading crown. Bark dark grey or blackish, rough, with shallow cracks exfoliating in rounded woody scales 5—2 inches across. Blaze 3.5—5 inch, hard, pinkish or orange-brown, sticky when crushed. Leaves 6—9 inches long, pari- or impari-pinnate, rachis not winged. Leaflets 4—6 pairs, subopposite, 2.5—5 inches long, lanceolate, long-acuminate, entire, somewhat oblique, glabrous, minutely petiolulate. Flowers 1 inch diameter, reddish, in lateral puberulous panicles, appearing with or just before the young leaves. Male flowers in compact panicles 2—6 inches long. Stamens 5—7. Female flowers in laxer panicles 6—10 inches long. Drupes 2.3 inch diameter, irregularly globose, glabrous, pink (at first).

Occurs throughout the hills between 2,000 and 6,000 feet. Often common in open situations on rocky ground and a limestone soil, sometimes clinging to precipitous limestone crags, not common on other soils. The young foliage is a bright pink. Flowers: March-April. Fruit: June-July.

6. *LANNEA*, A. Rich.

Deciduous trees. Leaves alternate, imparipinnate; leaflets entire. Flowers monœcious or dioecious, fascicled, in simple or panicle, terminal, fascicled racemes. Calyx 4-lobed, persistent; lobes imbricate.

Petals 4, imbricate. Disk annular, 8-lobed. Stamens 8, inserted below the disk. Male with deeply 4-lobed pistillode. Female ovary 4—6-celled or-lobed or usually 1-celled; styles 4. Fruit a compressed thinly fleshy drupe; stone hard.

Lannea grandis, *Engl. Syn. Odina* Woodier, Roxb. Vern. *Whingan*, Gen. *Kanman*. G. *Kalmina*, NG.—A small or medium-sized deciduous tree up to 6 feet girth and 50 feet high. Bark dark grey or blackish with pale often silvery-grey patches, roughish. Blaze .5—1 inch, pink or red with darker anastomosing broad fibrous bands. Leaves 12—18 inches long, crowded towards the ends of the branches. Leaflets 7—11, the lateral opposite, 3—6 by 2·3·5 inches, ovate or ovate-oblong, long-acuminate, entire, rather membranous, glabrous when mature, shining, base often oblique, lateral nerves 6—10 pairs. Petiolules of the lateral leaflets 0—1 inch long. Flowers .2 inch diameter, yellowish-green, 1-sexual, appearing when the tree is leafless, crowded in cymose fascicles arranged in the male in compound usually drooping racemes, in the female in simple racemes which are erect at first, crowded towards the tips of the branches. Drupes .5·6 inch long, ovoid, compressed, smooth, dull red or pink, containing a large stone surrounded by green succulent pulp.

Occurs throughout the area up to 4,000 feet. Very common in open miscellaneous types of forest. In the Bhabar it attains 10 feet girth and 75 feet high, but in the hills it is usually a small tree scarcely exceeding 3 feet girth. The fibrous bands in the bark serve to distinguish this species when leafless from *Spondias mangifera*. Flowers: March-April. Fruit: June-July.

7. SPONDIAS, *Linn.*

Deciduous glabrous trees. Leaves alternate, imparipinnate. Flowers polygamous, in terminal spreading panicles. Calyx small, 4-5-lobed, deciduous; lobes imbricate. Petals 4-5, valvate. Disk annular, 8—10-crenated. Stamens 8—10, inserted below the disk. Ovary 4-5-celled, immersed in the disk; styles 4-5, conniving above. Fruit a fleshy drupe with woody endocarp, 1—5-seeded.

Spondias mangifera, *Willd.* Vern. *Amāra* or *Amra*, Gen. *Amyan*, A. Eng. The Hog plum.—A small or medium-sized deciduous tree up to 6 feet girth and 40 feet high. Bark pale brown or silvery grey, sometimes partly blackish, smooth or nearly so. Blaze .75—1·5 inches, soft, cheesy, not fibrous, reddish-brown with white streaks paling towards the interior and exuding a sticky juice. Leaves 12—18 inches long. Leaflets 7—11, the lateral opposite, 3—7 by 1·5—3 inches, elliptic or elliptic-oblong, acuminate, entire, membranous, glabrous, with 10—30 pairs of horizontal secondary nerves joined by a strong intramarginal vein. Petiolules .2 inch long. Flowers .2·3 inch diameter, pale

greenish-yellow, sessile, clustered on the stout branches of a glabrous panicle 10—18 inches long, appearing when the tree is leafless. Drupes 1.5—2 inches long, ovoid or oblong, smooth, greenish-yellow, containing a large somewhat fibrous stone surrounded by the soft juicy mesocarp.

Occurs throughout the area up to 4,500 feet. Common in open dry miscellaneous forests. The leaves turn yellow before falling. Flowers: March—May. Fruit: December—February.

XXXI.—CORIARIACEÆ.

Glabrous shrubs, rarely annuals with angular twigs. Leaves opposite or ternate, simple, entire, exstipulate. Flowers small, green, hermaphrodite or polygamous, in axillary racemes. Sepals 5, imbricate, persistent. Petals 5, fleshy, keeled within, thickened and enlarged after flowering and embracing the fruit. Stamens 10, all free or 5 of them adnate to the petals; filaments short. Disk 0. Carpels 5—10, free, whorled on a fleshy receptacle; styles free, slender; ovules 1 in each cell. Fruit of 5 or 10 oblong compressed dry nuts; nuts 1-celled, 1-seeded.

CORIARIA, *Linn.*

Characters of the family.

***Coriaria nepalensis*, Wall.** Vern. *Makhio* or *Makroli*, NG. *Makāl*, NT. *Makab*, A.—A large deciduous or subdeciduous shrub up to 3 feet girth and 15 feet high. Bark dark grey or brown, very rough, more or less deeply cracked, exfoliating in small woody scales. Blade 3—35 inch, somewhat fibrous, pale yellow, the juice turning purple on the blade of a knife. Branches smooth with prominent circular lenticels. Twigs quadrangular. Leaves 1—4 by 7—25 inches, opposite, subsessile, ovate or elliptic, abruptly short-acuminate, entire or very obscurely serrate, glabrous, 3—5-nerved. Flowers 2 inch diameter, in axillary, solitary or clustered racemes 1—4 inches long. Pedicels 15—2 inch long. Stamens red, with large anthers as long as the filaments. Styles red. Fruit 2-3 inch diameter, of 5 distinct nuts enclosed within the accrescent succulent petals, red at first, finally blue-black when ripe.

Occurs throughout the hills between 4,000 and 8,000 feet. Fairly common on open southern aspects, often in secondary forest. Flowers: March-April. Fruit: April-June.

XXXII.—MORINGACEÆ.

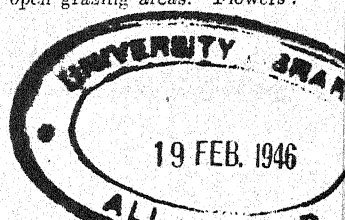
Trees with soft wood. Leaves deciduous, alternate, 2-3-pinnate, the pinnae and leaflets imparipinnate, opposite; stipules 0. Flowers irregular, hermaphrodite, in panicles. Calyx 5-cleft, the segments unequal, petaloid, imbricate. Petals 5, unequal, the 2 upper small, the lowest largest. Disk lining the calyx-tube. Stamens inserted on the margin of the disk, 5 perfect opposite the petals with 5—7 alternate sterile; filaments free; anthers 1-celled. Ovary stipitate, 1-celled; ovules many, biseriate, on 3 parietal placenta. Fruit an elongate, 1-celled, loculicidally 3-valved, beaked capsule, corky and pitted within. Seeds many.

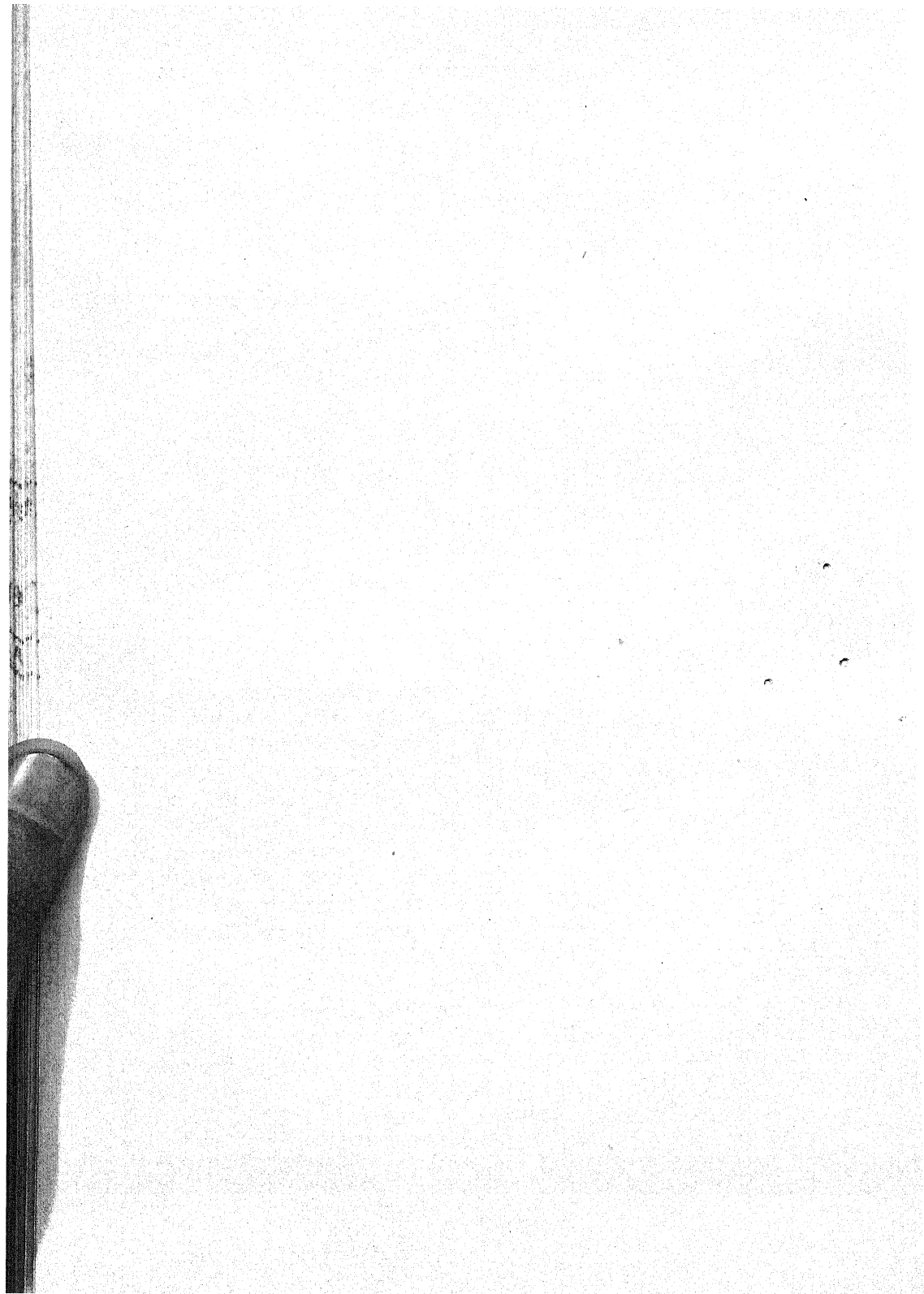
MORINGA, Lamk.

Characters of the family.

Moringa oleifera, Lamk. Syn. *Moringa pterygosperma*, Gært. Vern. *Sunara* or *Sundan*, SG and L. *Sainjna*, EA and H. Eng. The Horse-radish Tree.—A medium-sized deciduous tree. Bark very pale brown with sharply contrasting blackish portions, rough, thickly corky and deeply fissured. Blaze .8—1.8 inches, crisp, not fibrous or the innermost layer fibrous, pale yellow usually with a few narrow dark purple bands towards the interior and thickly mottled with orange sclerotic tissue towards the exterior. Young shoots tomentose. Leaves 1.5—3 feet long, usually 3-pinnate; rachis stout towards the base, slender towards the tip, terete, tinged purple. Pinnae about 6—10 pairs, the central ones the longest, up to 15 inches long. One or more conspicuous stalked glands at the junction of the pinnules, pinnae and rachis. Leaflets .4—1 inch long, the lateral elliptic, the terminal obovate and slightly larger, entire, membranous, pale beneath, nerves obscure. Petiolules of the lateral leaflets up to .1 inch long, of the terminal .2-.3 inch long. Flowers about 1 inch diameter, pink, in large terminal compound panicles 1-2 feet long, the lower branches axillary. Petals .5—.8 inch long, white, tinged pink at the base, without any yellow spots. Capsules 9—20 by .6—.8 inch, pendulous, 9-ribbed, slightly constricted between the seeds. Seeds 3-gonous, winged.

Occurs throughout the area up to 3,000 feet. Scarce within the hills, but common in the subhimalayan tract and often associated with *khair* in open grazing areas. Flowers: February—April. Fruit: May-June.





XXXIII.—LEGUMINOSÆ.

Herbs shrubs or trees. Leaves alternate, rarely opposite, usually compound, stipulate; leaflets often stipellate. Flowers usually irregular, hermaphrodite, rarely regular or polygamous. Sepals 5, combined or free, often unequal, sometimes 2-lipped. Petals 5, rarely fewer, usually free and unequal. Stamens normally 10, sometimes indefinite, perigynous or subhypogynous; filaments free or variously combined. Ovary free with 1 or more ovules on the ventral suture; style simple. Fruit usually dry, a pod splitting open along both sutures, sometimes continuous and indehiscent, sometimes separating into 1-seeded joints.

Analysis of sub-families.

- A. Flowers zygomorphic. Petals imbricate. Stamens 10 or fewer.
- | | | | | |
|-------------|---------------------|---------|---------|-----------------------------|
| (a) Corolla | papilionaceous. | Stamens | usually | |
| combined | ... | ... | ... | I.— <i>Papilionatæ</i> . |
| (b) Corolla | not papilionaceous. | Stamens | usually | |
| free | ... | ... | ... | II.— <i>Cæsalpinicidæ</i> . |
- B. Flowers regular. Petals valvate. Stamens 10 or indefinite
- | | | | | |
|-----|-----|-----|-----|--------------------------|
| ... | ... | ... | ... | III.— <i>Mimosoidæ</i> . |
|-----|-----|-----|-----|--------------------------|

Sub-family I.—*Papilionatæ*.

Herbs shrubs or trees. Leaves alternate, simple or compound, sometimes ending in tendrils. Flowers irregular, zygomorphic, rarely subregular, hermaphrodite, Calyx, gamosepalous, 5-toothed or-lobed or the 2 upper lobes more or less connate. Corolla papilionaceous; petals 5, free or adnate to the staminal tube, the posterior (standard) outside in bud, the 2 lateral (wings) intermediate, the 2 lower inside and usually cohering by their lower margins (keel). Stamens 10, diadelphous (usually 9 and 1, the vexillary free one opposite the standard), monadelphous or free.

I.—Trees.

A. Leaves trifoliolate.

1. Flowers scarlet.

- | | | | | |
|----------------------|-----|-----|-----|------------------------|
| (a) Branches armed | ... | ... | ... | 17. <i>Erythrina</i> . |
| (b) Branches unarmed | ... | ... | ... | 19. <i>Butea</i> . |

2. Flowers lilac

...	11. <i>Ougeinia</i> .
-----	-----	-----	-----------------------

B. Leaves of more than 3 leaflets (*D. Sissoo* has sometimes only 3).

- | | | | | |
|-----------------------------|-----|-----|-----|--------------------------|
| 1. Pod orbicular, winged | ... | ... | ... | 25. <i>Pterocarpus</i> . |
| 2. Pod elongate, not winged | ... | ... | ... | 24. <i>Dalbergia</i> . |

II.—Shrubs.

A. Leaves simple or trifoliate.

1. Flowers scarlet or red, large and conspicuous

- (a) Branches armed 17. *Erythrina*.
 (b) Branches unarmed 19. *Butea*.

2. Flowers not red, or if red not large and conspicuous.

A. Leaves gland-dotted beneath.

- (a) Leaves pinnately trifoliate 22. *Rhynchosia*.
 (b) Leaves simple or digitate 23. *Flemingia*.

B. Leaves not gland-dotted beneath.

(a) Flowers yellow, 1 inch long or more.

- * Leaves trifoliate 1. *Piptanthus*.
 ** Leaves simple 2. *Crotalaria*.

(b) Flowers not yellow, or if partly yellow not exceeding .5 inch long.

- * Pod of several joints folded so that the broad faces are in contact 10. *Uraria*.
 ** Pod not folded as above.
 † Pod indehiscent, not jointed, 1-seeded 9. *Lespedeza*.
 †† Pod jointed, usually several seeds 12. *Desmodium*.

B. Leaves pinnate (*Indigofera Hamiltonii* has sometimes only 3 leaflets).

1. Flowers yellow.

- (a) Pod ovoid, bladder-like, membranous 4. *Colutea*.
 (b) Pod 4-winged, constricted between the seeds 26. *Sophora*.
 (c) Pod turgid, not membranous, winged or moniliform.
 * Calyx very oblique 7. *Caragana*.
 ** Calyx not oblique 8. *Astragalus*.

2. Flowers not yellow.

- (a) Pod cylindrical 3. *Indigofera*.
 (b) Pod compressed 6. *Tephrosia*.

III.—Climbers.

A. Leaves trifoliate.

1. Pod large, turgid, densely clothed with irritating bristles 15. *Mucuna*.2. Pod small, turgid, pubescent 22. *Rhynchosia*.

3. Pod flat.

(a) Terminal leaflet exceeding 6 inches long.

- * A sinistrorse climber 18. *Spatholobus*.
 ** A dextrorse climber 20. *Pueraria*.

(b) Terminal leaflet not exceeding 4 inches long.

- * Flowers bright yellow 21. *Atylosia*.
 ** Flowers pink or purplish 14. *Shutteria*.

B. Leaves imparipinnate (*Apios* has sometimes only 3 leaflets).

- | | | | | |
|---|-----|-----|-----|------------------------|
| 1. Leaflets 3—5 | ... | ... | ... | 16. <i>Apios</i> . |
| 2. Leaflets 7—9, more than 3 inches long | ... | ... | ... | 5. <i>Milllettia</i> . |
| 3. Leaflets 9—13, less than 3 inches long | ... | ... | ... | 24. <i>Dalbergia</i> . |

C. Leaves paripinnate. Leaflets 7—20 pairs ... 13. *Abrus*.

1. PIPTANTHUS, *D. Don*.

A' shrub. Leaves digitately trifoliolate. Stipules deciduous, connate at the outer edges so as to appear opposite to the petiole. Flowers in bracteate racemes. Standard erect, broadly obcordate. Stamens 10, free. Pod stipitate, 2-valved.

Piptanthus nepalensis, *D. Don*.—An evergreen shrub 5—10 feet high, the stems attaining 1·5 inches diameter. Bark pale brown, fairly smooth, emitting a foetid smell when bruised. Blaze greenish-yellow. Twigs bright green. Young shoots silky. Petiole 7—1·5 inches long, narrowly margined. Stipules 5—8 inch long, deciduous leaving a persistent annular ring. Leaflets 2—4 by 5—1·5 inches, sessile, lanceolate or elliptic-oblanceolate, entire, acute, glabrous above, ultimately glabrous beneath, midrib stout and prominent beneath. Flowers 1·125 inches long, yellow fading purplish-brown, in short racemes. Pedicels 5—7 inch long, villous. Bracts 5 inch long, ovate, densely hairy. Calyx 5 inch long, densely grey-tomentose outside. Petals clawed. Pod 3—5 by 4—7 inch, flat, brown when ripe. Seeds 3—10.

Occurs in the hills, especially the inner ranges, between 9,000 and 11,000 feet (Parker records it from the Punjab down to 7,000 feet. He also describes it as deciduous, but in cases which I have seen the old leaves fall as the new are forming and it is at most subdeciduous). Generally scarce, but sometimes fairly common in open forest of *Quercus semecarpifolia*, especially on south aspects. Flowers: April-May. Fruit: October.

2. CROTALARIA, *Linn*.

Herbs or shrubs. Leaves simple, trifoliolate or sometimes 5—7-digitate, stipular or not. Flowers usually yellow, sometimes blue, mostly in racemes, rarely solitary. Calyx-lobes linear or lanceolate, subequal or more or less connate in two lips. Corolla equal to or exceeding the calyx, keel petals connate into a conspicuously incurved beak. Stamens monadelphous; anthers dimorphous, alternately short versatile with stender filaments and long basifixed with flattened filaments. Ovary 2-many-ovuled; style long, abruptly incurved at the base. Pod turgid or inflated, continuous within, dehiscent, not jointed. Seeds usually many.

Crotalaria tetragena, *Roxb*.—An erect sparingly-branched shrub 3—6 feet high, the stem attaining 1 inch diameter at base. Bark smooth, greenish. Twigs green, quadrangular, deeply grooved, clothed

with whitish hairs. Leaves simple, 6—12 by .5—1.75 inches, linear or lanceolate, acuminate, entire, base rounded or acute, glabrescent or thinly silky-canescens on both sides. Petiole .1—25 inch long, stout, tomentose. Stipules .1-2 inch long, linear, hairy. Flowers yellow, 1.1-2 inches long, in lax simple lateral and terminal racemes 6—9 inches long. Calyx .75—1 inch long, velvety, linear or lanceolate, acuminate. Corolla glabrous. Pedicels .3—6 inch long, velvety. Pod 1.5—2 inches long, oblong, turgid, densely clothed with rough hairs. Seeds 12—20, shining, indigo blue.

Occurs throughout the area up to 3,500 feet, but is rather scarce. Found in dry open situations. The hairiness of this plant is often described as dark brown as it turns brown in the herbarium. Flowers: September—November. Fruit: March.

3. INDIGOFERA, Linn.

Herbs or shrubs. Leaves simple, trifoliate or imparipinnate; leaflets entire; stipules usually small. Flowers generally small, usually reddish or purple, in axillary racemes or spikes, rarely solitary or panicled, each flower pedicelled in the axil of a caducous bract. Calyx minute, teeth subequal or the lowest longest. Standard ovate or orbicular; keel petals erect, not keeled, spurred near the base. Stamens diadelphous, the vexillary stamen free, the others connate. Ovary sessile or subsessile. Pod usually linear-cylindric, septate within between the seeds.

I.—Dwarf shrubs; stems tufted and mainly annual.

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|--------------------------|-----|-----|------------------------|
| 1. Leaflets less than 15 | ... | ... | 1. <i>Hamiltonii</i> . |
| 2. Leaflets more than 15 | ... | ... | 2. <i>Dosua</i> . |

II.—Erect shrubs with perennial stems.

A. Flowers pink.

- | | | | |
|------------------------------|-----|-----|------------------------|
| 1. Pod hairy, bracts minute. | | | |
| (a) Flowers .4—6 inch long | ... | ... | 3. <i>Gerardiana</i> . |
| (b) Flowers .2—35 inch long | ... | ... | 4. <i>heterantha</i> . |

2. Pod glabrous.

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|---|-----|-----|-------------------------|
| (a) Bracts boat-shaped exceeding the buds | ... | ... | 5. <i>pulchella</i> . |
| (b) Bracts minute, lanceolate | ... | ... | 6. <i>cylindracea</i> . |

B. Flowers deep red.

- | | | | |
|---------------------------------------|-----|-----|--------------------------|
| (a) Bracts lanceolate. Leaflets 11—15 | ... | ... | 7. <i>atropurpurea</i> . |
| (b) Bracts boat-shaped. Leaflets 5—9 | ... | ... | 8. <i>hebeptala</i> . |

1. Indigofera Hamiltonii, R. Grah.—A small deciduous shrub with numerous diffuse stems from the root. Leaves 1—3.5 inches long. Leaflets usually 3—9, opposite, .5-.7 inch long, obovate or oblong, often emarginate, sparsely adpressed-pubescent on both surfaces. Flowers pink tinged with red, .4-.5 inch long, in long-peduncled racemes 8—12 inches long which usually arise direct from the rootstock. Bracts small, lanceolate, caducous, shorter than the pedicels. Pod 1.1-5 inches long, straight, compressed. Seeds about 10.

This species is found in the Patli Dun at 1,300 feet elevation. It grows in the open flat grasslands which are annually burnt. Flowers: March-April.

2. *Indigofera Dosua*, Buch.-Ham.—A small deciduous shrub with procumbent or suberect tufted stems 1-2 feet long and attaining .25 inch diameter. These die back annually either to the base or leaving a small persistent portion. Leaves 2-4.5 inches long. Leaflets 15-37, opposite, .3-.6 inch long, elliptic, mucronate, more or less densely adpressed-hairy on both surfaces. Flowers bright pink, .4-.6 inch long, in peduncled racemes 2-4 inches long. Bracts narrow-lanceolate, long-pointed, exceeding the flower-buds. Pod .8-1.5 inches long, straight, minutely pubescent, containing up to 8 seeds.

Occurs throughout the hills between 4,000 and 9,000 feet. Very common in open *chir* or blanks in *banj* forest, often concealed beneath dense grass. Flowers: April-July. Fruit: November-January.

3. *Indigofera Gerardiana*, Wall. Vern. *Sakina*, Gen.—A medium-sized deciduous shrub, usually 5-10 feet high, but attaining 20 feet with stem 6 inches diameter. Bark dark grey or brown, fairly smooth, sometimes with shallow vertical cracks. Blaze .2-.25 inch, pinkish. Young shoots adpressed-hairy. Leaves 1-4 inches long. Leaflets 5-23, .4-.8 by .2-.3 inch, obovate or oblong, obtuse or retuse, mucronate, clothed on both sides with adpressed white hairs. Flowers .4-.6 inch long, in racemes 1-3 inches long. Rachis and pedicels densely adpressed-hairy. Pedicels up to .1 inch long, stout, not recurved in bud. Calyx .15 inch long, rather densely hairy, with 5 lanceolate teeth. Corolla rather densely hairy outside, especially towards the margins. Standard pink, often tinged purple, with a white spot at the base. Alæ red. Keel white tinged pink on the margins. Pod .75-2 inches long, straight, cylindric, clothed with pale adpressed hairs or glabrescent when mature, never quite glabrous. Seeds up to 10.

Found throughout the hills between 6,000 and 10,000 feet. Common and often gregarious in secondary scrub forest, especially on old abandoned clearings. Also commonly associated with *banj*, blue pine and spruce. Flowers: May-July. Fruit: October-April.

4. *Indigofera heterantha*, Wall. Syn. I. *Gerardiana*, var. *heterantha*. Vern. *Sakina*, Gen.—This shrub is very similar to I. *Gerardiana*, Wall, from which it is best distinguished by its smaller size. Points of difference are as follows:—Height usually 2-5 feet, attaining 10 feet with stems 1.5 inches diameter. Leaflets 7-35, up to .4 inch long. Flowers .2-.35 inch long. Calyx .05-.1 inch long, lobes linear-lanceolate. Pod .4-.75 inch long. Seeds 1-4.

Occurs throughout the hills between 3,000 and 8,000 feet. Common and often gregarious in secondary scrub forest, especially bordering cultivation. Also commonly associated with *banj*, *chir* and blue pine. Flowers: May-June. Fruit: October-April.

5. *Indigofera pulchella*, Roxb. Vern. *Sakina*, Gen.—An erect deciduous shrub 4-8 feet high, stems attaining 2 inches diameter. Bark brown, fairly smooth, often with longitudinal lines of small raised lenticels. Blaze .25 inch, pinkish. Young shoots adpressed-pubescent.

Leaves 3—6 inches long. Leaflets 7—17, opposite, .5—1 inch long elliptic, rounded or retuse at the apex, mucronate, thinly hairy on both sides, more or less glaucous beneath. Petiolule very short. Flowers about .5 inch long, bright pink, in dense racemes 2—4 inches long. Bracts boat-shaped, long-pointed, silky-hairy, exceeding the flower-buds. Pod 1-1.7 inches long, straight, glabrous.

Found in all parts of the area from 1,000 to 5,000 feet. Common in *sal*, miscellaneous and *chir* forests where the cover is not too dense. At times somewhat gregarious. Flowers: January—April. Fruit: May-June.

6. *Indigofera cylindracea*, Wall.—A deciduous shrub 2—8 feet high, with stems up to 1.5 inches diameter. Bark smooth, grey, with numerous minute raised lenticels. Blaze .1 inch or less, fibrous, greenish. Young shoots sparsely adpressed-hairy. Leaves 1—5 inches long. Leaflets 9—21, .4—8 by .2—3.5 inch, oblong, obtuse or retuse, mucronate, clothed on both sides with minute adpressed hairs. Flowers .3-.4 inch long, pink, in lax pedunculate racemes 2—6 inches long which lengthen in fruit up to 8 inches. Rachis and pedicels sparsely adpressed-hairy. Pedicels up to .2 inch long, slender, recurved in bud. Calyx scarcely exceeding .05 inch long, sparsely adpressed-pubescent without, with 5 triangular teeth. Petals rather densely puberulous without. Bracts shorter than the pedicels. Pod 1-1.8 inches long, straight, cylindric, glabrous. Seeds 4—6.

This species is common and somewhat gregarious round Naini Tal between 5,500 and 8,000 feet, where it occurs mainly as undergrowth in *Quercus dilatata* forest. I have seen here a variety with white flowers. It reproduces very freely by root-suckers. Flowers: July. Fruit: November.

7. *Indigofera atropurpurea*, Buch.-Ham.—An erect sparingly-branched shrub 4—8 feet high with stems up to 1 inch diameter. Bark smooth, greenish-brown with minute pale raised lenticels arranged more or less in longitudinal lines. Leaves 4—10 inches long. Leaflets 11—15, opposite, 1.25—2.5 by .5—1 inch, elliptic-or ovate-oblong, rounded or acute, mucronate, thinly hairy or glabrous, base rounded or acute. Petiolule .1—2 inch long. Flowers dark red, about .4 inch long, in erect racemes 4—10 inches long. Bracts lanceolate, acuminate, not enclosing the flower-buds. Pod 1-2 inches long, glabrous. Seeds up to 9.

Occurs throughout the hills between 3,000 and 4,000 feet, but is generally scarce. Sometimes found on bare steep slopes. Flowers: June—August. Fruit: December.

8. *Indigofera hebetata*, Benth.—An erect deciduous sparingly-branched shrub 5—15 feet high with stems up to 2 inches diameter. Bark smooth, pale ashy or greenish-brown with minute raised lenticels. Young shoots sparsely hairy. Leaves 4—8 inches long. Leaflets 5—9,

opposite, 1·5—3 by ·75—1·5 inches, ovate or oblong, apex rounded or retuse, mucronate, sparsely hairy or glabrous above, sparsely hairy beneath, base rounded or acute. Petiolule ·05—·1 inch long. Flowers dark red, about ·4 inch long, in erect racemes 4—6 inches long. Standard deep red with a white spot at the base. Alæ pink. Keel pink or red, the base white. Pedicels up to ·1 inch long. Bracts boat-shaped with long cuspidate points, enclosing the flower-buds. Pod 1-2 inches long, glabrous.

Occurs in the hills, and especially on the inner ranges, between 7,000 and 9,000 feet. Sometimes locally common, but generally scarce. It is usually found in fairly dense forest, often of *Quercus dilatata*. Flowers: May-June.

4. COLUTEA, Linn.

Shrubs. Leaves imparipinnate. Stipules small. Flowers in few-flowered axillary racemes. Calyx campanulate, 5-toothed, the teeth subequal or the 2 upper shorter. Standard rounded, bi-plicate or bi-calloso at the base, shortly clawed; keel-petals incurved, obtuse, with long connate claws. Stamens diadelphous. Ovary stipitate; ovules many; style longitudinally bearded above. Pod membranous, inflated; indehiscent or opening at the top.

Colutea, nepalensis, Sims. Syn. *C. arborescens*, Linn. var. *nepalensis*.—An erect deciduous shrub. Bark smooth, brown. Young shoots pale straw-coloured, the epidermis peeling off in long narrow strips. Leaves 2—6 inches long, mostly clustered on very short dwarf shoots. Leaflets 9—13, opposite, ·2—·5 inch long, obovate, usually retuse, entire, rather thick, clothed when young with minute adpressed hairs, glabrous above when mature. Petiolules minute. Flowers about ·8 inch long, yellow often tinged with red, in lax axillary few-flowered racemes about as long as the leaves. Pedicels ·3-·4 inch long, canescent. Pod 1·5—2 inches long, bladder-like, ovoid. Seeds many.

This plant is recorded by Brandis from Kumaon, but there are no specimens from this area at either the Kew or Dehra Dun herbaria. It may be expected to occur from 8,000 to 11,500 feet. Flowers: July-August.

5. MILLETTIA, W. and A.

Trees or large shrubs, usually climbing. Leaves imparipinnate, stipulate; leaflets penninerved, usually stipellate. Flowers often fascicled in racemes or panicles. Calyx campanulate, the teeth short. Corolla much exserted; standard ovate or orbicular; wings and keel-petals clawed. Stamens usually monadelphous, sometimes diadelphous. Ovary sessile or rarely stalked, few-ovuled. Pod linear or oblong or oblanceolate, flat or turgid, late in dehiscing.

Millettia auriculata, Baker. Vern. *Gauja* or *Gauj*, Gen. *Gōj*, H.—A large dextrorse climber, the stem attaining 10 inches diameter and 70 feet high, often irregularly fluted. Bark pale yellowish-brown, fairly smooth or roughish owing to the presence of numerous small raised lenticels. Blaze 1—3 inch, pale orange, crisp, not fibrous, with a narrow whitish band of very fibrous tissue inside, sometimes exuding a transparent sticky pink juice. Leaves 1.2-5 feet long. Petiole 4—6 inches long, swollen at the base. Leaflets 7—9, opposite, terminal leaflet up to 12 inches long, lateral ones 2.5-6 by 2—4 inches, obovate, elliptic or oblong, abruptly short-acuminate, entire, densely grey-silky when young, glabrous above when mature, but pubescent beneath, dull green above, paler and somewhat glaucous beneath. Petiolule .2 inch long. Flowers .3-.4 inch long, white tinged yellowish-brown, in slender axillary racemes 4—12 inches long; pedicels clustered, .1 inch long. Pod 4—7 by 1-1.5 inches, woody, brown-velvety, sutures thickened.

Occurs throughout the area up to 4,000 feet and is often very common, especially in dry miscellaneous and *sal* forest. It is often found as a suberect shrub 5—10 feet high, and in this state is frequently gregarious. Flowers: May-June.

6. TEPHROSIA, Pers.

Herbs or shrubs. Leaves imparipinnate, sometimes reduced to one leaflet; leaflets opposite, obliquely parallel-nerved, stipels small or 0. Flowers reddish or white, usually racemose. Calyx-tube campanulate, teeth subequal or the lower longer. Petals clawed; standard suborbicular; wings slightly adnate to the incurved keel petals. Stamens diadelphous, the vexillary filament connate above the base or free. Ovary sessile, linear, many-ovuled; style incurved. Pod linear, flattened, not or obscurely septate, dehiscing by both sutures. Seeds many.

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| A shrub exceeding 3 feet high; leaflets more than 19. | |
| Flowers .75 inch long or more ... | ... 1. <i>candida</i> . |
| A shrub less than 3 feet high; leaflets less than 19. | |
| Flowers not exceeding .4 inch long ... | ... 2. <i>Hamiltonii</i> . |

1. Tephrosia candida, DC. Vern. *Ban-tor*.—An erect shrub 3—6 feet high, the stem attaining 1.25 inches diameter. Bark fairly smooth with numerous pale circular raised lenticels. Blaze .2 inch, greenish, very fibrous. Leaves 4—9 inches long, shortly stalked. Leaflets 17—25, narrowly elliptic, cuspidate at the apex, 1.5—3 inches long, glabrous or pubescent above, conspicuously pale and silky beneath. Petiolule short. Flowers .75—1 inch long, white or tinged with red, in terminal or lateral racemes 6—9 inches long. Pedicels about .5 inch

long. Pods 2·5—4 by about ·3 inch, densely clothed with adpressed silky-brown hairs. Seeds 6—13, dark brown, compressed, ·15—·25 inch long.

Occurs up to 2,500 feet, but is not common. Found in open *sal* forest. Flowers: August-September. Fruit: January-February.

2. *Tephrosia Hamiltonii*, J. R. Drumm.—An erect deciduous shrub 1—3 feet high with a basal woody portion up to ·6 inch diameter, the twigs sub-herbaceous. Bark smooth with minute pale lenticels. Young shoots more or less pubescent. Leaves 1·5-5 inches long. Leaflets 7-17, oblanceolate-oblong, ·5—1 inch long, entire, usually retuse at the apex, mucronate, adpressed-hairy above, silky-pubescent beneath. Petiolules ·05 inch long. Flowers ·3—·5 inch long, bright pink, in fascicles or pairs on the rachis of terminal or leaf-opposed racemes 1—7 inches long. Pedicels in flower ·1—·15 inch long. Calyx and back of standard puberulous, remainder of corolla glabrous. Calyx ·2—·25 inch long. Pod 1-1·5 inches long by ·15—·2 inch broad, somewhat upcurved near the tip, pilose becoming glabrous or nearly so when ripe. Seeds 4—7, pale brown mottled darker, about ·1 inch long.

Occurs on sandy and gravelly soils, often on abandoned cultivation and in river beds within the Bhabar tract where it is a common weed and sometimes grows gregariously. It also extends some distance up valleys in the hills at elevations up to 3,000 feet. Flowers: June—August. Fruit: January-February.

7. CARAGANA, *Lamk.*

Trees shrubs or herbs. Leaves paripinnate, often crowded, sometimes digitate; rachis ending in a bristle or spine usually persistent; stipules usually large and spinescent. Flowers yellow, solitary or in few-flowered umbels. Calyx companulate; teeth deltoid or lanceolate. Corolla much exserted; standard broad, clawed, edges reflexed; wings oblique, free, long-clawed; keel blunt, nearly straight. Stamens diadelphous. Ovary sessile; style straight or slightly incurved; ovules many. Pod turgid, continuous, sometimes pubescent within.

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|---|-----|--------------------------------|
| I.—Leaflets more or less digitate ... | ... | 1. <i>pygmæa</i> . |
| II.—Leaves imparipinnate. | | |
| A. Stem dwarf, less than 6 inches high. | ... | 2. <i>crassicaulis</i> . |
| B. Stems 1 foot or more in height. | | |
| 1. Flowers in few-flowered umbels ... | ... | 3. <i>brevispina</i> . |
| 2. Flowers solitary or paired, sub-sessile. | | |
| (a) Leaflets 12—18 ... | ... | 4. <i>sp. aff. sukiensis</i> . |
| (b) Leaflets 8—10. | | |
| * Stipules connate behind the leaf-rachis ... | ... | 5. <i>Gerardiana</i> . |
| ** Stipules not connate behind ... | ... | 6. <i>Hoplites</i> . |

According to Strachey and Winterbottom's list of Kumaon plants *C. polyacantha*, Royle is also found within our area but there are no specimens at Dehra Dun and the sheets at Kew collected in Garhwal by Strachey and Winterbottom do not show the pods. It seems therefore possible that it has been confused with *C. Gerardiana* as the two plants have very similar characters. According to Dr. Prain the pod of *C. polyacantha* is glabrous within.

1. *Caragana pygmæa*, DC. Vern. *Dam*, NG. *Dimar*, NA.—A low dense bushy and very prickly shrub, the spreading stems usually 6—12 inches high and seldom exceeding .5 inch diameter. Bark fairly smooth, grey, peeling off in lateral rolls. Leaf-rachis .3—.4 inch long, persistent with the spinescent stipules as a 3-fid spine, suppressed on dwarf shoots; leaflets 4, digitate, very narrowly oblanceolate, about .3 inch long, thickish, pubescent when young, glabrous when mature. Flowers solitary, about .6 inch long, yellow tinged with orange-brown on the standard. Pod linear, turgid, glabrous within and without, 1 inch long.

Occurs in the tract of country bordering Tibet between 12,500 and 15,000 feet. It is locally common and gregarious on bare stony ground, often forming dense continuous patches several feet across. Flowers: June-July.

2. *Caragana crassicaulis*, Benth. A dwarf shrub with stout woody tufted and branched stems 2—4 inches high, more or less completely hidden by the persistent leaf-rachises. Leaves closely crowded on the stem, 1—5 inches long. Stipules not spinescent, villous. Leaflets 18—30, opposite towards the leaf-tip, alternate below, .1—.2 inch long, oblong, clothed with long spreading hairs, apex rounded or truncate. Flowers yellow, .7 inch long, occurring singly on pedicels up to 2 inches long. Calyx .4 inch long, clothed with long spreading hairs. Pod .6—.7 inch long, straight, turgid, sparsely hairy.

Occurs on the inner dry ranges between 12,000 and 15,000 feet. Flowers: July.

3. *Caragana brevispina*, Royle.—An erect shrub 4—8 feet high with stems up to 2 inches diameter. Bark brown, roughish. Blaze .25 inch, fibrous, white. Branches smooth; internodes not crowded, .5—2 inches long. Leaf-rachis usually spinescent and persistent, 1—4 inches long. Stipules spinescent, up to .5 inch long or absent. Leaflets 8—14, .3—1 inch long, obovate, elliptic or elliptic-oblong, apex rounded or retuse, mucronate, glabrous above, pale and silky-pubescent or glabrescent beneath. Flowers yellow, about .9 inch long, in few-flowered umbels; peduncle .5—2 inches long; pedicels .2 inch long. Pod 1.2—2 inches long, pubescent without, woolly within.

This species is reported to occur in the Ranikhet, Central Almora, and East Almora Divisions but there are no specimens from this area at Dehra Dun, and I saw none in the Kew herbarium so that its occurrence cannot at present be definitely accepted. Elsewhere it is found in *deodar* and blue pine forests between 6,000 and 10,000 feet. Flowers: May—July.

4. *Caragana* sp. aff. *C. sukiensis*, C. K. Schn.—An erect deciduous shrub 1—3 feet high with stems up to .5 inch diameter. Leaf-rachis persistent, spinescent, 1.1—1.5 inches long. Leaflets 12—18, opposite, .25—.3 inch long, oblanceolate-oblong, mucronate, glabrous,

entire, subsessile. Flowers solitary, on short pedicels. Calyx 4 inch long with lanceolate acuminate teeth. Pod 7—1 inch long, pubescent without, woolly within.

This description is taken from my sheet No. 1016 in the Dehra Dun herbarium. The specimen, which is in fruit, appears to differ from true *C. sikiensis* in the larger number of leaflets which are also glabrous and mucronate. It was collected between 8,500 and 9,500 feet elevation in the Malla Nagpur patti of North Garhwal and more material is wanted for correct determination.

5. *Caragana Gerardiana*, Royle. Vern. *Juāra*, NG. *Natha*, NA.—A shrub 2—4 feet high, the stems usually decumbent and attaining 1 inch diameter. Bark rough, brown, peeling off in thin lateral plates. Leaf-rachis 5-15 inches long, persistent, spinescent; stipules connate behind the rachis, amplexicaul, not spinescent, thick, persistent, coriaceous. Leaflets 8—10, oblanceolate, 2—3 inch long, acute, densely silky. Flowers 1-2, subsessile, yellow, about 8 inch long. Pod 7—1 inch long, woolly within and persistently pubescent without.

Occurs in the tract of country bordering Tibet between 9,000 and 12,000 feet. It is locally common and gregarious, often forming dense bushy patches. The old dead spines remain long on the stem and make the bushes very prickly. Flowers: May-June.

6. *Caragana Hoplites*, Dunn.—An erect shrub 1—6 feet high with stems up to 2 inches diameter. Old bark very rough. Blaze 3 inch, fibrous, white. Young twigs smooth, often coloured orange-brown. Leaf-rachis 1—14 inches long, sharply pointed, persistent. Leaves crowded on dwarf side shoots 75—12 inches long, tip spinescent, with ovate scarious bracts at the base. Leaflets 8—10, shortly stalked, 3—35 inch long, linear-ob lanceolate, clothed on both surfaces with long soft spreading hairs, somewhat densely beneath, undersurface with 4—6 pairs of very prominent parallel nerves. Flowers solitary, about 1 inch long, very shortly stalked, yellow fading to orange-brown. Calyx hairy, more than half the length of the corolla, teeth lanceolate-acuminate.

This species grows on steep bare grassy and rocky slopes between 9,000 and 9,500 feet in the Nandagini valley above Sutol. The foliage has a somewhat glaucous appearance. Flowers: June.

8. ASTRAGALUS, Linn.

Herbs or shrubs. Leaves impari- or paripinnate, rarely digitate or reduced to one leaflet, unarmed or very spiny from the indurated leaf-rachises; stipules free or united to the leaf-rachis, rarely united into a sheath. Inflorescence various. Calyx with short nearly equal teeth. Corolla usually distinctly exserted; petals usually with long claws; keel incurved, obtuse. Stamens diadelphous. Ovary sessile or stipitate; style incurved. Pod various, usually turgid, continuous and much

inflated or more or less completely longitudinally divided by a double membranous ingrowth from the dorsal suture.

I.—Leaf-rachis ending in a leaflet; leaflets 15—31 ... 1. *Candolleanus*.

II.—Leaf-rachis ending in a spine; leaflets 8—14.

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| 1. Leaves .5—1.2 inches long. Pod .4—1.5 inch long | ... | 2. <i>psilocentros</i> . |
| 2. Leaves 1—2 inches long. Pod .8—1.9 inch long | ... | 3. <i>ægacanthoides</i> . |

Three other woody species are mentioned in Strachey's list of Kumaon plants, namely:—(1) *A. polyacanthus*, Royle is shown as occurring in the Dhaul Valley at 7,000 feet. This is probably the plant here described as *A. psilocentros*, Fisch. Var. *pilosus*.—(2) *A. multiceps*, Wall. is recorded from Milam. There are no specimens from this locality in the Dehra Dun herbarium, but there are two specimens one from Badrinath (collector's name not given) and one from Kulti in Byans collected by Duthie, either or both of which may belong to this species, their fragmentary nature however leaves it open to doubt whether the specimens are not *A. Candolleanus*, Royle. *A. multiceps*, Wall. has no terminal leaflet, the leaflets are densely silky and the plant has a tufted congested habit similar to that of *A. Candolleanus*.—(3) *A. Webbianus*, Grah. is recorded from Guje, but there are no specimens from this area at Dehra Dun. In this species there is a terminal leaflet and the dwarf stems are tufted and densely caespitose near the ground surface. There are 31—51 leaflets on a stout rachis up to 9 inches long.

1. ***Astragalus Candolleanus*, Royle.**—A suberect or prostrate shrub with flexible shoots up to 12 inches long and about .4 inch diameter, the terminal 3-4 inches clothed with the persistent dead leaf-rachises. Internodes usually crowded. Leaves 2.5—5 inches long, imparipinnate; the rachis not terminating in a spine. Stipules .3-.4 inch long. Leaflets 15—31, elliptic or oblong, .2-.4 inch long, apex rounded or emarginate, more or less silky-hairy. Flowers yellow, .8-.9 inch long, in heads, sessile or more or less peduncled. Pedicels .1-.2 inch long. Pod .6-.7 inch long, triangular in section, clothed with spreading silky hairs, abruptly narrowed into the persistent style.

Occurs on the inner ranges between 10,000 and 13,000 feet. Flowers: June-July. Fruit: October.

2. ***Astragalus psilocentros*, Fisch.**—A much-branched semipro-cumbent shrub with stout woody branches. Stipules scarious, connate almost to the apex and leaving an annular scar on the twigs, clothed with long ciliate hairs. Rachis pilose, spinescent, .5—1.2 inches long, becoming glabrous after the leaflets have fallen. Leaflets 4-5 pairs, .2-.3 inch long, elliptic-oblong, obtuse, pilose on both surfaces but more densely beneath. Flowers solitary or paired, .7-.8 inch long, yellow. Pedicels very short, pilose. Calyx pilose, about half the length of the corolla. Pod .4-.5 inch long, abruptly narrowed into the persistent style, hirsute.

Occurs near Tapoban in North Garhwal at 6,500 feet where it is found growing on open exposed grassy slopes. The plant here described is var. *pilosus*. Flowers: May.

3. ***Astragalus ægacanthoides*, Parker.**—A suberect shrub 4—12 inches high with stout woody stems. Internodes usually crowded. The terminal 2-3 inches of the shoot is more or less clothed with the

persistent dead leaf-rachises. Young shoots sparsely pubescent. Leaves 1-2 inches long, paripinnate. Petiole spinescent. Stipules adnate to the petiole, membranous, amplexicaul, up to .3 inch long, acuminate. Leaflets 4—7 pairs, .15—.25 inch long, elliptic-oblong, hairy on both sides when young, glabrous above but slightly hairy beneath and on the margin when mature, lateral nerves obscure. Flowers yellow, .9 inch long, axillary, solitary on peduncles up to .15 inch long. Pedicels .1—.15 inch long. Calyx .35 inch long, hairy; teeth subequal, less than half the length of the tube. Alæ with short auricles at the base and slightly saccate below the middle. Pod .8-.9 inch long, cylindric, glabrescent or slightly hairy without, villous within. Seeds .12 inch long, sub-quadrilateral.

Occurs on the inner dry ranges bordering Tibet in East Almora between 10,000 and 13,000 feet. It is found on rocks and dry banks and also in open blue pine forest where according to Mr. R. N. Parker it forms tufts 6 feet across and 12 inches high. Flowers: May-June. Fruit: September.

9. *LESPEDeza*, Michx.

Herbs or shrubs. Leaves pinnately 3-foliolate, rarely 1-foliolate; leaflets entire without stipels; stipules free, small. Flowers in axillary fascicles or racemes or terminal panicles. Calyx-tube campanulate, teeth 5 subequal or the 2 upper slightly connate. Corolla exserted; standard clawed; keel petals incurved, obtuse or beaked. Stamens diadelphous, 9 and 1. Ovary sessile or stalked, 1-ovuled; style incurved. Pod small, compressed, 1-seeded, indehiscent.

A. Shrubs seldom exceeding 2 feet high. Flowers clustered or in shortly peduncled umbels.

- | | | | |
|-----------------------|-----|-----|------------------------|
| 1. Calyx .1 inch long | ... | ... | 1. <i>sericea</i> . |
| 2. Calyx .3 inch long | ... | ... | 2. <i>Gerardiana</i> . |

B. Shrubs usually 3—6 feet high. Flowers in racemes ...

- | | | | |
|----------------------|-----|-----|------------------------|
| 1. Racemes sessile | ... | ... | 3. <i>stenocarpa</i> . |
| 2. Racemes peduncled | ... | ... | 4. <i>eriocarpa</i> . |

1. *Lespedeza sericea*, Miq.—An undershrub sending up erect annual shoots 1—3 feet high from a woody rootstock. Shoots single or branched, slender not exceeding .2 inch diameter, green, striate, clothed with pale pubescence. Leaves trifoliolate, crowded. Petiole up to .15 inch long, usually very short. Leaflets .3—.8 inch long, oblanceolate, linear-cuneate or linear-oblong, apex rounded or truncate, mucronate, entire, glabrous or nearly so above, densely grey-silky beneath. Flowers pale yellow tinged with pink. .15—.25 inch long, sessile or shortly peduncled, arranged 2—4 together in dense axillary clusters. Calyx .1 inch long. Pod .1 inch long, thinly silky.

Occurs throughout the hills between 5,000 and 7,500 feet. Often common on grassy, especially southern, aspects; also in open *chir* and *banj* forest. Flowers: July—September.

2. *Lespedeza Gerardiana*, Grah.—Habit of *L. sericea* but more often unbranched and the stems do not exceed .1 inch diameter as a rule. Leaves trifoliate, petiole up to .15 inch long. Leaflets subequal, sessile .5—.7 by .15—.25 inch, clothed beneath with pale grey hairs. Flowers pale yellow, the keel tipped with purple and a dash of the same colour near the base of the standard, .4-.5 inch long, arranged in umbels of 4—8 flowers, the umbels either sessile or on a peduncle up to 1 inch long. Calyx .3 inch long. Pod .1 inch long, grey-tomentose.

Occurs throughout the hills between 5,000 and 7,000 feet. Habitat similar to that of *L. sericea*. Common, but not so abundant as *L. sericea*. Flowers: August—October.

3. *Lespedeza stenocarpa*, Maxim.—An erect subdeciduous shrub 4—8 feet high with stem up to 3 inches diameter. Branches slender, whippy and often drooping. Bark pale reddish-brown, rough. Twigs densely tomentose with spreading hairs. Leaves trifoliate. Petiole .2—1 inch long. Leaflets up to .7 by .5 inch, cuneate-obovate or obovate, apex obtuse truncate or retuse, often minutely mucronate, entire, glabrous above, densely clothed with grey or silvery silky hairs beneath. Flowers bright pink tinged with purple, .4-.5 inch long, in dense axillary racemes up to 1.5 inches long. Pod .5 inch long, oblong, gradually narrowed into the base of the persistent style.

Occurs probably in all parts of our area between 1,500 and 6,500 feet. Sometimes common in open *chir* forest and often found growing on steep stony or rocky ground but especially on limestone soils. Flowers: March—May.

4. *Lespedeza eriocarpa*, DC.—An erect deciduous shrub 4—8 feet high with stems up to 1 inch diameter. Bark brown, slightly rough. Branches slender. Twigs densely clothed with adpressed grey pubescence. Leaves trifoliate. Petiole .5—2.3 inches long; stipules lanceolate, persistent, .2—.25 inch long. Leaflets up to 1.8 by .9 inch, rarely less than .7 inch long, elliptic or obovate, apex rounded, mucronate rarely slightly retuse, base rounded or more or less cuneate, glabrous above, glaucous with fine adpressed silky hairs beneath. Stalk of the terminal leaflet up to .5 inch long, petiolules of the lateral up to .1 inch long. Flowers bright red or deep purplish-red fading to purple, .4-.5 inch long, in lax erect axillary racemes up to 6 inches long. Pod .3-.4 inch long, mucronate with adpressed grey hairs.

Occurs throughout the hills between 5,000 and 7,500 feet, but is somewhat local in its appearance and seldom common. Sometimes found in open grassy *banj* forest. Flowers: August—October. Fruit: December-January.

10. URARIA, Desv.

Perennial herbs and undershrubs. Leaves imparipinnate or 3-foliate, often 1-foliate, with subulate stipels; stipules scarious. Flowers usually purple or yellow, in terminal simple or paniced racemes.

Calyx-tube short, 2-lipped, the upper 2-partite, the lower 3-partite. Corolla small; standard orbicular or obovate, clawed; wings adherent to the obtuse keel. Stamens diadelphous, 9 and 1. Ovary sessile, 2-many-ovuled; style inflexed. Pod of 2—8 small turgid 1-seeded indehiscent joints usually bent on one another so as to become more or less face to face when ripe.

- A. Upper leaves 5—9-foliolate 1. *picta*.
- B. Leaves 1-and 3-foliolate.
 - 1. Joints of pod shining, glabrous 2. *neglecta*.
 - 2. Joints of pod hairy.
 - (a) Petiole .5—1 inch long. Pedicels .1-.2 inch long 3. *hamosa*.
 - (b) Petiole 2—4 inches long. Pedicels .3-.4 inch long 4. *lagopus*.

1. ***Uraria picta*, Desv.**—A sparingly-branched erect undershrub usually 1-2 feet high, somewhat woody towards the base. Leaves 4—12 inches long, the lowest 1—3-foliolate; stipules .5 inch long, lanceolate, acuminate. Leaflets (of the upper leaves) 5—9, opposite, 3—8 by .4—1 inch, linear-oblong, subcoriaceous, blotched with white above along the midrib, glabrous above, minutely pubescent with prominent nerves beneath. Flowers .2-.3 inch long, purple, in close fascicles along the rachis of a spicate, erect, terminal raceme 6—12 inches long. Bracts .4—-.7 inch long. Pedicels .2-.3 inch long, abruptly upcurved after flowering so that the pods are in contact with the rachis. Pods glabrous, pale lead-coloured or whitish, joints 3—6, smooth, polished.

Has been collected in the Ramnagar Division, but is probably not common in our area. It ascends to 3,000 feet. In the Dehra Dun it is found in open *sal* forests. Flowers: June—August. Fruit: October-November.

2. ***Uraria neglecta*, Prain.**—A deciduous shrub with weak suberect, prostrate or creeping, often herbaceous stems 1-2 feet long and not exceeding .15 inch diameter. Leaves 1-and 3-foliolate. Petiole .5—2 inches long. Terminal leaflet 1.5—3.5 inches long, oblong. Flowers .3 inch long, purple, in long dense cylindric racemes. Pedicels .3-.4 inch long, incurved after flowering. Pod of several shining, black, glabrous joints folded on one another so that their broad faces are in contact.

Probably occurs in most parts of our area between 1,000 and 6,000 feet. It is found on open grassy banks, in openings in *sal* forest, and sometimes beneath dense tall grass. Flowers: August-September. Fruit: October-November.

3. ***Uraria hamosa*, Wall.**—A straggling diffuse undershrub. Leaves 1-and 3-foliolate, the terminal leaflet usually more than twice the size of the lateral. Terminal leaflet 2—4 inches long, broadly elliptic, obtuse or emarginate, base rounded, pubescent or glabrescent above, adpressed hairy beneath. Petiole .5—1 inch long. Flowers .25—-.3 inch long,

pink or purple, fascicled 1 or 2 together on the rachis of a simple or branched raceme 3—10 inches long. Pedicels slender, .1-.2 inch long, incurved at the apex after flowering. Rachis and pedicels more or less densely pubescent. Bracts .2—.4 inch long, ovate, cuspidate, rather densely adpressed-hairy, ciliate, caducous but conspicuous in bud. Pod of 4—8 minutely pubescent joints folded on one another so that their broad faces are in contact.

This species is believed to occur in the subhimalayan tract below 2,000 feet, but there are no specimens from this area at Dehra Dun and I did not see any in the herbarium at Kew. It has however been collected at Asarori in the Dehra Dun. Flowers: September. Fruit: November-December.

4. *Uraria lagopus*, DC.—An erect or occasionally subscandent, subdeciduous shrub 3—6 feet high with stems up to .5 inch diameter. Bark fairly smooth, reddish-brown. Leaves usually attached so that the petioles incline in a backward direction. Leaves 1-and 3-foliate; stipules .3-.4 inch long, cuspidate-acuminate. Petiole 2—4 inches long. Leaflets 1.5—4.5 inches long, ovate or oval, obtuse or emarginate, entire, more or less scabrous above, pubescent on the nerves beneath. Flowers .3 inch long, purple, in cylindric often paniced racemes 4—12 inches long. Pedicels .3-.4 inch long, incurved after flowering. Pod of 2—6 black hairy joints folded on one another so that their broad faces are in contact.

Occurs in the central ranges between 4,000 and 6,500 feet, but is not common. It is usually found as an undershrub in *banj* forest. Flowers: August-September. Fruit: October—March.

11. OUGEINIA, Benth.

A tree. Leaves stipellate; stipules free, deciduous. Calyx-tube campanulate, the lobes obtuse, in 2 lips, the upper of 2 connate, the lower of 3. Corolla exserted; petals clawed; standard suborbicular; wings spurred, slightly adnate to the obtuse incurved keel. Stamens diadelphous, 9 and 1. Ovary sessile, many-ovuled; style incurved. Pod linear, of 2 or more scarcely dehiscent joints.

Ougeinia dalbergioides, Benth. Vern. *Sāndan*, Gen.—A medium-sized subdeciduous tree commonly attaining about 4 feet girth and 30 feet high. Bark varying from pale pinkish-brown to dark bluish-grey, somewhat rough, exfoliating in irregular thin soft scales. Blaze .4—.6 inch, very fibrous, white closely streaked and speckled with blood-red, exuding a blood-red sticky juice which turns purple on the blade of a knife. Leaves pinnately trifoliate. Petiole 2—6 inches long, swollen at the base. Leaflets broadly ovate, rounded or trapezoidal, the lateral oblique; all entire, glabrous above, downy or glabrescent beneath. Terminal leaflet 3—6 by 2.3-5 inches, lateral rather smaller. Flowers lilac, .3-.4 inch long, in short fascicled racemes from the nodes of the

old branches. Pedicels .5—8 inch long, filiform, usually fascicled. Pod 2—4 by .3 inch, flat, jointed.

Common in most parts of our area between 1,000 and 5,000 feet. It sometimes tends to gregariousness in *sal* forest, and is a characteristic species of limestone soils. The branches of a tree bearing flowers are usually leafless at this period, whilst branches not bearing flowers may still be in full leaf. The exposed portions of roots produce root-suckers in great abundance. The leaves form a favourite cattle fodder. Flowers: March—May. Fruit: May—June.

12. DESMODIUM, Desv.

Herbs or shrubs, rarely small trees. Leaves pinnately 1—3-rarely 5-foliolate; stipules free or united into a single leaf-opposed one; stipellate. Flowers usually in dense racemes, sometimes in axillary umbels or fascicles. Calyx-tube short, campanulate or turbinate, the 2 upper teeth more or less connate, the 3 lower acute or acuminate. Corolla exserted; standard obovate or orbicular; wings more or less adhering to the keel; keel petals incurved, sometimes spurred towards the claw. Stamens usually diadelphous, 9 and 1, sometimes monadelphous, sometimes with the vexillary filament free in the upper half. Ovary sessile or stalked, 2-many-ovuled; style incurved. Pod of several 1-seeded usually indehiscent joints, more rarely dehiscent along one suture.

I.—Leaves simple.

A. Petiole broadly winged.

- | | |
|--------------------------|------------------------------|
| 1. Stem erect | 1. <i>triquetrum</i> . |
| 2. Stem prostrate | 2. <i>pseudotriquetrum</i> . |

B. Petiole not winged.

- | | |
|--|------------------------|
| 1. Leaf glabrous or silky-pubescent above. | |
| (a) Flowers .15 inch long | 3. <i>gangeticum</i> . |
| (b) Flowers .4-.5 inch long | |
| * Pod glabrescent | 4. <i>gyrans</i> . |
| ** Pod densely hairy | 5. <i>gyroides</i> . |
| 2. Leaf hispid above | 6. <i>latifolium</i> . |

II.—Leaves trifoliolate.

A. Flowers in heads or umbels.

- | | |
|--|------------------------|
| 1. Flowers hidden by pairs of foliaceous bracts... | 7. <i>pulchellum</i> . |
| 2. Flowers not hidden by bracts | 8. <i>Cephalotes</i> . |

B. Flowers in racemes or panicles.

- | | |
|--|----------------------------|
| 1. Stems usually prostrate | 9. <i>polycarpum</i> . |
| 2. Stems usually erect. | |
| (a) Petiole usually not exceeding 1 inch long. | |
| * Pod 1—1.5 by .2 inch. | |
| † Pod glabrescent | 4. <i>gyrans</i> . |
| †† Pod densely hairy | 5. <i>gyroides</i> . |
| ** Pod .5—.7 by .1 inch | 10. <i>concinnum</i> . |
| (b) Petiole usually exceeding 1 inch. | |
| * Pod more than .2 inch across | 11. <i>tiliæfolium</i> . |
| ** Pod less than .2 inch across. | |
| § Hairs of pod not hooked | 12. <i>sambuense</i> . |
| §§ Hairs of pod hooked. | |
| † Flowers .2 inch long | 13. <i>laxiflorum</i> . |
| †† Flowers .3-.4 inch long. | |
| (i) Leaves dull green and adpressed hairy above | 14. <i>sequax</i> . |
| (ii) Leaves shining and glabrescent above | 15. <i>laburnifolium</i> . |

In addition, the following four species which have been regarded by some authors as more or less woody have not been described here as the stems are both slender and apparently annual, and the rootstock is scarcely if at all woody. *D. parvifolium*, DC. has procumbent tufted stems and 1-or 3-foliate leaves with leaflets .2—·5 inch long and blue or pink flowers in lax racemes. It is abundant in grass land up to 7,000 feet. *D. reniforme*, DC. has creeping stems, 1-foliate leaves .5—1 inch broad of a characteristic reniform shape and small pink flowers in lax racemes. It has been collected in the Almora district between 3,000 and 4,000 feet. *D. oxyphyllum*, DC. and *D. podocarpum*, DC. are very similar in general appearance. They have erect stems with rather large trifoliate leaves, the terminal leaflet usually 1—3 inches long, and small pink flowers in long terminal racemes. They are both found in the hills between 3,000 and 8,000 feet.

1. *Desmodium triquetrum*, DC.—An erect shrub 3—6 feet high with obtusely 3-angled branches. This shrub is very similar to but larger in all its parts than *D. pseudotriquetrum*. Joints of pod rather densely adpressed-hairy throughout.

Has been collected from the Haldwani Division at 1,500 feet, but it appears to be scarce. According to Haines it is found in damp localities. Flowers: August–September. Fruit: December–March.

2. *Desmodium pseudotriquetrum*, DC.—A prostrate deciduous undershrub with weak spreading stems 1—3 feet long and up to .15 inch diameter, the basal portion more or less woody and persistent, sometimes rooting at the nodes. Twigs triquetrous. Leaves 1-foliate. Leaflet 2—4·5 by 1·25—2 inches, ovate oblong or lanceolate, entire, acute, base truncate or sub-cordate, glabrous or with scattered hairs above, glaucescent and hispid on the nerves beneath; lateral nerves prominent 6—10 pairs. Stipules .5–·6 inch long, persistent. Petiole up to 1·5 inches long, winged, wing oblanceolate up to .3 inch across. Flowers .25 inch long, purple, in lax axillary and terminal racemes about 6 inches long. Pod 1 by .2–·3 inch, composed of 6—8 joints, glabrous on the faces, hispid along both sutures.

Occurs throughout the Bhabar and central and outer ranges between 1,000 and 5,000 feet and is not uncommon in grassy blanks or along paths in *sal* forest. Flowers: July–September. Fruit: January–February.

3. *Desmodium gangeticum*, DC.—An erect or suberect deciduous or subdeciduous undershrub with herbaceous or woody stems 2—5 feet high and up to .5 inch diameter. Leaves 1-foliate. Leaflet variable in size, up to 6 by 3 inches, orbicular, ovate, or rarely lanceolate, base rounded or subcordate, gradually narrowed in the upper portion, entire, glabrescent above, glaucescent and clothed with fine adpressed silky hairs beneath. Stipules persistent, .2—·5 inch long. Petiole .5—1·25 inches long. Flowers .15 inch long, purple or white, in slender arching terminal and axillary racemes up to 12 inches long. Pedicels .15 inch long. Pod .5—1 by .1 inch, straight or falcate, minutely hairy, composed of 5—8 joints.

Occurs throughout the area up to 6,000 feet. Fairly common, sometimes in dry miscellaneous forest, also in *sal* forest of moderate density. The blade is usually set

at a characteristic angle with the petiole sometimes as much as a right angle. Flowers: June—August. Fruit: October—December.

There is a variety found chiefly in open grass lands at low elevations which is common and appears to be fairly distinct. The stems are diffuse or procumbent and very slender, not exceeding .1 inch diameter. The leaves are also smaller, being only 1.5—3 by 1—1.75 inches. This may be var. *maculatum*, F. B. 1.

4. *Desmodium gyrans*, DC. Eng. The Telegraph Plant.—An erect sparingly-branched deciduous undershrub 3—7 feet high, with stem up to .5 inch diameter. Bark smooth, reddish-brown. Leaves 1—3-foliolate, the terminal leaflet 2—4 by .3—1.5 inches, linear-lanceolate or oblong-lanceolate, obtuse at both ends, entire, glabrous above, more or less silky-hairy beneath; lateral leaflets much smaller or obsolete. Petiole .2-1 inch long. Flowers pale mauve, the standard and keel fading yellowish, the wings tinged with indigo, .4-.5 inch long, in lax axillary and terminal, often paniced racemes. Pedicels .25 inch long, glandular-hairy. Pod 1—1.5 by .2—-.25 inch, flat, glabrescent, black when ripe, composed of 6—10 joints, the pod curling and appearing falcate after the seeds have fallen.

Occurs probably throughout the area between 1,000 and 6,500 feet. Abundant in grassy *chir* forest, and is often found on the most exposed southern aspects. The upper portions of the stem frequently die back in the cold weather. Flowers: August-September. Fruit: October—December.

5. *Desmodium gyroides*, DC.—An erect sparingly-branched shrub with stems up to 10 feet high and 1 inch diameter. Bark smooth reddish-brown. Twigs slender, sparsely silky-pubescent. Leaves 1—3-foliolate, the terminal leaflet 1.25—3 by .75—2 inches, elliptic, apex rounded, base rounded or subcordate, entire, with silky adpressed hairs on both surfaces, pale green above, somewhat glaucous beneath; main lateral nerves 7-8 pairs; lateral leaflets very much smaller or obsolete. Petiole .4—1.4 inches long. Flowers deep purple, .5 inch long, in axillary and terminal rarely paniced racemes 1-2 inches long; bracts ovate, .35 inch long, concealing the buds. Pod 1—1.5 by .15—-.2 inch, flat, black when ripe, rather densely clothed with long spreading fulvous hairs, the pod gradually curling and becoming falcate. Seeds 6—9.

Occurs near Pilapani in the Haldwani Division, but has not been recorded further west. It is usually found in *sal* forest and does not seem to penetrate into the hills. Unlike *D. gyrans* it prefers the shade of forest to open grassy areas. Flowers: August-September. Fruit: November-December.

6. *Desmodium latifolium*, DC.—An erect deciduous shrub 2—6 feet high, the stem attaining .5 inch diameter. Leaves 1-foliolate. Leaflet up to 6 by 5 inches, broadly ovate, base cordate or truncate, margin repand, harshly pubescent above, tomentose beneath; main lateral nerves prominent beneath, 7—9 pairs including the basal. Petiole .5—1.25 inches long. Flowers purple, .2-.3 inch long in rather dense, ascending, axillary and terminal, densely brown-hairy racemes up to 8

inches long. Pedicels less than .1 inch long. Pod .5—.7 by .1 inch, composed of 4—6 joints, densely clothed with hooked hairs.

Occurs throughout the area between 1,000 and 4,000 feet. Seldom common, though perhaps most frequently found in dry miscellaneous forests. Flowers: August–September. Fruit: November–December.

7. *Desmodium pulchellum*, Benth.—An erect deciduous shrub 2—6 feet high, with stems up to .5 inch diameter. Bark smooth, reddish-brown with numerous minute pale lenticels. Leaves trifoliolate. Petiole .3—.5 inch long. Leaflets oblong-lanceolate or elliptic, obtuse or subacute, rounded at the base, entire or sinuate, glabrous and dull green above, finely downy and glaucescent beneath; main lateral nerves impressed above and raised beneath. Terminal leaflet 2.5—5 by 1.2—2.25 inches, lateral ones about half the terminal. Stalk of terminal leaflet .5—.8 inch long. Flowers white or tinged with pink, .2-.3 inch long, arranged in clusters of 2—6 in erect terminal and axillary racemes 2—10 inches long, each cluster concealed by a pair of orbicular leaf-like bracts placed back to back; bracts .4-.5 inch across, glabrous above, finely downy beneath. Pod .2-.3 inch long, completely hidden by the bracts, composed of 1-2 glabrous or downy joints.

Occurs in the Bhabar tract between 1,000 and 2,000 feet. Sometimes gregarious and often common in *sal* forest of medium density. Flowers: July—September. Fruit: December—February.

8. *Desmodium Cephalotes*, Wall.—An erect deciduous shrub 3—5 feet high, the stems up to .4 inch diameter. Twigs triquetrous. Leaves trifoliolate. Petiole 1—1.5 inches long. Leaflets oblong or obovate-oblong, usually acute, glabrous above, grey-silky beneath; lateral nerves 10—18 pairs, parallel, depressed above and prominent beneath. Terminal leaflet 3—6 by 1.5—3.5 inches, lateral smaller. Stalk of terminal leaflet .5—1 inch long. Flowers white, .3-.4 inch long, 20 or more together in dense, umbellate, axillary, pedunculate heads .5—.75 inch across. Peduncles solitary, .1—.3 inch long, silky. Pedicels up to .1 inch long, silky. Pod .3—.5 by .15 inch, composed of 2—4 joints clothed with adpressed silky pale grey hairs.

Occurs in the subhimalayan tract up to 2,000 feet. Sometimes fairly common in *sal* forest of moderate density. Flowers: July—September. Fruit: December—February.

9. *Desmodium polycarpum*, DC.—A suberect or prostrate deciduous undershrub, the stems not exceeding .15 inch diameter, sometimes herbaceous and annual, often rooting adventitiously, and 1—3.5 feet long. Leaves trifoliolate. Petiole .4—1 inch long. Stipules .3—.5 inch long, persistent. Leaflets suborbicular, broadly elliptic or obovate,

rounded at both ends, often retuse, glabrous above, glaucous and adpressed silky-hairy beneath. Terminal leaflet 1·3—2·5 by 1—1·5 inches, the lateral smaller. Stalk of terminal leaflet ·2—·4 inch long, petiolules of the lateral ·05 inch long. Flowers purple, ·2—·3 inch long, in axillary and terminal rather dense racemes up to 3 inches long. Pedicels slender, ·1·2 inch long. Bracts ·2 inch long, exceeding the buds, cuspidate, caducous. Pod ·5—·9 by ·1 inch, composed of 4—8 joints clothed with minutely hooked rusty hairs.

Occurs probably throughout this area between 1,000 and 7,000 feet. Usually found on grassy banks in the hills, and is sometimes abundant in rather open *sal* forest. Flowers: August-September. Fruit: November-February.

The plant described above is var. *trichocaulon*, Baker. The type is also not uncommon in damp grassy *choars* in the east of the Haldwani Division. This is a more robust plant with erect stems up to 4 feet high and ·3 inch diameter. The leaves are slightly larger and narrower in proportion than in the variety described. The tertiary nerves are conspicuous and parallel. Stipules attain ·9 inch long. Leaves turn purplish before falling.

10. *Desmodium concinnum*, DC.—An erect sparingly-branched deciduous shrub 3—6 feet high with slender attenuated branches and stems up to 1 inch diameter. Bark fairly smooth, dark grey or purplish-brown with minute pale lenticels. Leaves trifoliolate, the lateral leaflets sometimes wanting. Petiole up to 1 inch long. Stipules ·3—·5 inch long, persistent. Leaflets up to 3 by 1·2 inches, elliptic-oblong, rounded at both ends, entire, clothed on both sides with very fine adpressed silky hairs, pale and glaucescent beneath; lateral nerves 7—10 pairs, prominent beneath. Stalk of terminal leaflet ·3 inch long, petiolules of the lateral ·05 inch long. Flowers deep purple or lilac fading blue, in slender axillary and terminal drooping racemes 6—12 inches long. Pedicels usually in pairs, slender, ·3—·5 inch long. Pod ·5—·7 inch long, less than ·1 inch wide, set at an angle with the pedicel, composed of 3—6 minutely hairy joints.

Occurs throughout the hills from 2,500 to 6,000 feet. Common in *banj* forest, and less frequently in *chir*. Flowers: September-October. Fruit: November-May.

11. *Desmodium tiliaefolium*, G. Don. Vern. *Chamlai*, Gen.—A deciduous shrub 5—15 feet high, with stems up to 3 inches diameter. Bark fairly smooth, pale grey with minute lenticels. Blade ·25 inch, pinkish, fibrous. Leaves trifoliolate. Petiole up to 5 inches long. Leaflets orbicular, ovate or obovate, base cuneate or rounded, apex obtuse or abruptly short-acuminate, margins sinuate, glabrous or sparsely hairy above, glabrous or tomentose beneath. Terminal leaflet up to 4 by 3·5 inches, the lateral smaller and oblique. Stalk of terminal leaflet ·5—1 inch long, petiolules of the lateral ·1·2 inch long. Flowers pale lilac or mauve, ·4—·6 inch long, in terminal lax much-branched often leafy panicles up to 12 inches long. Pedicels slender, ·2·3 inch long. Pod

1.5—2.5 by .25 inch, thin, flat, thinly adpressed-hairy, composed of 6—9 joints.

Throughout the hills between 4,500 and 8,500 feet. Often very common and gregarious over large areas in *banj* or spruce forests on north aspects. Also common in blue pine and cypress forests. The immature leaves are pinkish. Flowers: June—September. Fruit: November—April.

12. *Desmodium sambuense*, DC.—An erect or suberect deciduous shrub usually 6 inches to 2 feet high, but exceptionally the stem attains 6 feet high and .5 inch diameter. Bark slightly rough, reddish-brown with numerous small raised lenticels. Twigs triquetrous, clothed with long soft silky pubescence. Leaves trifoliolate. Petiole 1-2 inches long. Leaflets up to 3 by 2 inches, ovate or obovate, silky-hairy or glabrescent above, more or less densely silky-hairy beneath, entire, usually rounded at both ends; lateral leaflets slightly oblique. Stalk of terminal leaflet .3—-.5 inch long, petiolules of the lateral .1 inch long. Flowers purplish-pink or pale mauve, .3-.4 inch long, in axillary and terminal racemes or panicles. Pedicels .2 inch long. Pod .7—1 by .1 inch, densely clothed with brown adpressed hairs, composed of 6—8 joints.

Throughout the hills between 3,500 and 7,500 feet. Common in *chir* and open *banj* forest, often on hot southern aspects. Flowers: June—August. Fruit: October—February.

13. *Desmodium laxiflorum*, DC.—An erect deciduous undershrub 1-2 feet high with stems up to .3 inch diameter. Bark reddish-brown, fairly smooth with minute lenticels. Leaves trifoliolate. Petiole 1—3 inches long. Leaflets ovate or broadly lanceolate, base narrowed or rounded, apex acute, entire, membranous, hairy above when young glabrescent when mature, glaucous beneath with fine adpressed hairs and prominent nerves. Terminal leaflet 2—7 by 1—3.5 inches, the lateral smaller and slightly oblique. Stalk of terminal leaflet .5—1.25 inches long, petiolules of lateral leaflets up to .1 inch long. Flowers .2—-.25 inch long, in slender drooping axillary and terminal racemes 6—12 inches long. Corolla pale yellow, the wings and keel more or less broadly margined with purple fading to indigo blue. Pedicels slender, .2-.3 inch long, usually clustered. Pod 1—1.5 by .1 inch, composed of 4—10 joints clothed with minute hooked hairs.

Occurs practically throughout the area between 1,000 and 5,000 feet. Somewhat gregarious and often common in shady moist ravines in miscellaneous or *sal* forest. The leaves become tinged with purple before falling. Flowers: July—September. Fruit: October—November.

14. *Desmodium sequax*, Wall.—An erect deciduous (?) shrub 4—8 feet high with stems up to 1 inch diameter. Branches spreading. Bark fairly smooth, reddish-brown with numerous minute pale raised lenticels. Leaves trifoliolate. Petiole 1—1.25 inches long. Leaflets ovate ovate-lanceolate or rhomboid, base rounded, apex acute or

acuminate, margin sinuate, dull green and minutely adpressed-hairy above, glaucous and clothed with short adpressed hairs beneath. Terminal leaflet up to 5 by 2·5 inches, lateral ones smaller and slightly oblique. Stalk of terminal leaflet ·5 inch long, petiolules of the lateral ·1 inch long. Flowers pink, ·3·4 inch long, in axillary and terminal panicles. Pedicels ·2 inch long. Pod placed at right angles with the pedicel, ·5—1·5 by ·1 inch, composed of 5—13 joints, densely clothed with minute brown hooked hairs.

Occurs throughout the area between 1,000 and 6,000 feet. Often locally abundant, but generally scarce. Usually found growing on recent landslips or on fresh boulder formations bordering large streams. Flowers: August-September. Fruit: January-February.

15. *Desmodium laburnifolium*, DC.—A shrub 3—6 feet high with stems up to 1 inch diameter. Branches spreading. Bark pale brown, fairly smooth with scattered small circular lenticels. Blaze ·05 inch or less, fibrous, greenish. Leaves 3-foliolate. Petiole ·7—1·5 inches long. Leaflets oblong-lanceolate, acute, shining dark green and glabrescent with prominent slightly raised primary nerves above, pubescent on the nerves beneath. Terminal leaflet 4—6·5 by 1·25—2 inches, lateral leaflets about two-thirds of the terminal. Stalk of terminal leaflet ·3—·8 inch long. Flowers whitish, ·3·4 inch long, in racemes 3—6 inches long. Pedicels ·2·3 inch long. Pod 2·25—3·5 by ·15 inch, somewhat falcate, densely covered with yellowish hooked hairs, composed of 5—8 segments easily detached whilst the fruit is still unripe.

Occurs in the subhimalayan tract and outer hill ranges up to 3,000 feet. It prefers moist shady localities and swampy ground bordering streams. Flowers: July—September.

13. *ABRUS*, Linn.

Climbing shrubs. Leaves pinnate with many pairs of leaflets, the rachis ending in a bristle; stipules deciduous; stipels minute. Flowers fascicled on axillary racemes or short axillary branches. Calyx-tube small, campanulate, the teeth short. Corolla much exserted; standard clawed, slightly adherent to the staminal tube; keel curved. Stamens 9, in a sheath, the vexillary one absent. Ovary sessile, many-ovuled; style incurved, not bearded. Pod oblong or linear, thinly septate between the seeds, dehiscent.

Pod flat, seeds compressed. Leaflets oblong ... 1. *pulchellus*.

Pod turgid, seeds round. Leaflets linear or linear-oblong 2. *precatorius*.

1. *Abrus pulchellus*, Wall.—A deciduous dextrorse climber with slender flexible branches, the stem attaining 20 feet high and ·4 inch diameter. Bark reddish-brown with minute pale circular lenticels. Leaves paripinnate; rachis 3·5—6 inches long. Leaflets membranous, 7—12 pairs, opposite, ·6—1·6 by ·25—·5 inch, oblong, rounded at both

ends, glabrous or glabrescent above when mature, with pale adpressed hairs beneath. Flowers pink, '4·5 inch long, in pedunculate one-sided terminal racemes 1-2 inches long, the peduncle attaining 6 inches in fruit. Pod 2-2·5 by '4 inch, flat, adpressed-hairy. Seeds 8-12, compressed, greenish-brown, '2 inch long.

Probably occurs throughout the area between 1,500 and 4,000 feet. Apparently never very common. Found in dense *sal* forest as well as open miscellaneous forest. Flowers: August-September. Fruit: December-February.

2. *Abrus precatorius*, Linn. Vern. *Ratti*, Gen.—A deciduous dextrorse climber, with slender flexible and tough branches, the stem attaining 15 feet high and '5 inch diameter. Leaves 2-4 inches long, paripinnate; rachis produced beyond the last pair of leaflets as a soft bristle. Leaflets 10-20 pairs, opposite, increasing slightly in size from the base, '3-'9 by '15-'25 inch, linear or linear-oblong, thinly membranous, entire, rounded at both ends, glabrous above when mature, thinly adpressed-silky beneath. Flowers '4·5 inch long, pink, clustered on tubercles arranged along the rachis of a one-sided, usually leaf-bearing, axillary, pedunculate raceme 2-4 inches long. Pod 1-1·7 by '4·5 inch, turgid, thinly pubescent, with a sharp deflexed beak. Seeds 3-6, ovoid, '3 inch long, scarlet with a black spot at the hilum, polished.

Occurs throughout the area up to 3,000 feet. Sometimes not uncommon in dry miscellaneous forest, especially open scrub and secondary growth. The seeds are very poisonous. Flowers: August-September. Fruit: October-March.

14. *SHUTERIA*, *W. and A.*

Slender climbers. Leaves pinnately 3-foliate; stipules scarious; stipels subulate. Flowers in axillary racemes; bracts persistent. Calyx-tube gibbous, teeth distinct, the 2 upper connate, the lateral ones shorter than the others. Corolla exserted; standard clawed, not spurred, exceeding the spurred wings and united obtuse keel. Stamens diadelphous, 9 and 1. Ovary subsessile, many-ovuled; style incurved, not bearded, filiform. Pod linear, flat, usually recurved, dehiscent, not jointed, slightly septate.

***Shuteria densiflora*, W. and A.**—A slender dextrorse evergreen climber with stems up to 15 feet high and '3 inch diameter, at least sometimes perennial, but scarcely woody. Bark pale brown. Twigs pubescent. Leaves trifoliate. Petiole 1·2-3·5 inches long. Leaflets subequal, 1·3-3·5 by '7-2 inches, ovate or ovate-rhomboid, apex apiculate rounded or retuse, base rounded or cuneate, glabrous or with a few long adpressed hairs on the midrib beneath when young. Petiolules '1 inch long, hairy. Flowers pale yellow tipped with purple, '3·4 inch long, in dense axillary fascicled racemes 1-3 inches long

with brown striate bracts clothing the rachis. Often with one or more reduced leaves present near the base of the raceme. Pod 1—1·5 by ·2 inch, flat, glabrous. Seeds 5—8.

Probably occurs throughout the area between 1,000 and 4,000 feet, but does not appear to be common. Flowers: December—February. Fruit: March-April.

This species is liable to be mistaken for *Shuteria vestita*, W. and A. var. *involutrata* which it closely resembles. The latter plant has, I believe, only annual stems and has therefore not been separately described. It may be recognised by the pubescent undersurface of the leaflets, the longer inflorescence and slightly larger flowers and by the presence of 1—3 whorls of sessile usually orbicular reduced leaflets on the floral axis below the flowering portion. The pod also is persistently hirsute.

15. MUCUNA, *Adams*.

Twining shrubs or herbs. Leaves pinnately 3-foliolate; stipules deciduous; stipels minute. Flowers large, purple or greenish, mostly fascicled on the tumid nodes of racemes which are axillary or lateral on the old branches or stems. Calyx-tube widely campanulate, the lowest tooth long, the lateral short, the upper 2 connate. Corolla much exerted; standard about half the length of the wings and keel, auricled at the base; keel incurved. Stamens diadelphous; anthers dimorphous, the longer basifixed, the shorter ovate or bearded. Ovary sessile, villous, 2-many-ovuled. Pod usually covered with fine irritating pungent bristles.

Mucuna imbricata, DC.—A dextrorse deciduous climber, the stem attaining 30 feet high and 4 inches diameter. Bark rough, dark reddish-brown. Branches very tough, smooth, reddish-brown with minute raised lenticels. Blaze 3—6 inch, fibrous, pale yellow or pinkish streaked and stippled with pinkish or purplish-brown, the juice turning purple on the blade of a knife. Petiole 2—10 inches long, swollen at the base. Leaflets elliptic, caudate-acuminate, membranous, sparsely adpressed-hairy above and below. Terminal leaflet 5—7 by 3—5 inches, lateral smaller and oblique. Stalk of terminal leaflet 5—2·5 inches long, petiolules of the lateral 2·3 inch long. Flowers dark purple, 2·25—2·5 inches long, in dense pendent racemes on a peduncle 5—15 inches long, sometimes arising from the old wood. Pedicels 5 inch long, clustered in threes, each cluster supported in bud by large concave green deciduous bracts. Pod 4·5 by 1·25—1·75 inches, the faces covered with close oblique plaits, and with two wings 2·5—5 inch wide running along each suture, densely clothed with yellowish-brown irritating bristles. Seeds 2—4, 9—1·1 inches long, polished, pinkish-grey blotched with black and with a broad black hilum.

Probably occurs in all parts of the area between 2,000 and 3,500 feet. Often common, especially in well-wooded ravines. Flowers: August-September. Fruit: February.

Several authorities have stated that *M. atropurpurea*, DC. is also to be found within our area. I have however seen no specimen of this plant at either the Kew

or Dehra Dun herbaria and it seems probable that the statement was incorrect. The two plants are similar in general appearance, but in *M. atropurpurea*, which is a South Indian species, the leaves are glabrous and the pods, though covered with close oblique plaits and densely covered with bristles, lack the wings which are such a characteristic feature of *M. imbricata*.

16. APIOS, *Mæch.*

Climbers. Leaves pinnately 3—7-foliolate. Flowers in lax racemes with tumid nodes. Calyx-teeth shorter than the tube, two upper connate, lowest linear, the two others short, deltoid. Corolla much exserted, the much incurved keel exceeding the standard, the wings still shorter. Stamens diadelphous. Ovary sessile; ovules many; style very long, filiform, beardless, much incurved. Pod linear, compressed.

***Apios carnea*, Benth.**—A dextrorse deciduous climber with flexible scarcely woody stem attaining 15 feet high and 2½ inch diameter. Leaves 3—5—usually 5-foliolate. Petiole 2—4 inches long. Leaflets subequal, opposite, 2½—5 by 1½—2 inches, elliptic-oblong, acuminate, entire, base rounded or obtuse, hairy on both surfaces, main lateral nerves 5—7 pairs. Petiolule hairy, 1½ inch long. Flowers 8—1 inch long, reddish, in axillary one-sided racemes 6—18 inches long. Pedicels fascicled or solitary. Calyx 4½ inch long, minutely pubescent outside. Pod minutely pubescent, flat, straight, 3—5 by 2½—3 inch with 6—12 seeds. Seeds brown with dark purple streaks.

This plant has been collected near Sankot, Pindarpar in North Garhwal at 7,000 feet. It was found growing in open oak forest. Flowers: September.

17. ERYTHRINA, *Linn.*

Trees or rarely undershrubs, the branches usually prickly. Leaves pinnately 3-foliolate; stipules small; stipels gland-like. Flowers showy, scarlet or sometimes white, in pairs or fascicles arranged in racemes. Calyx spathaceous or campanulate with very short teeth. Corolla much exserted, the standard much exceeding the wings and keel. Stamens 10, the vexillary filament nearly free or connate with the others half way up, the rest free above, alternately longer and shorter. Ovary stipitate, many-ovuled. Pod turgid, dehiscent, not jointed.

- I.—A shrub up to 15 feet high. Flowers September–October ... 1. *arborescens*.
 II.—Trees. Flowers March–April.
 1. Mature leaflets downy beneath. Seeds dull brown ... 2. *suberosa*.
 2. Mature leaflets glabrous or nearly so. Seeds bright red ... 3. *glabrescens*.

1. *Erythrina arborescens*, Roxb.—A deciduous shrub, the stem attaining 15 feet high and 4 inches diameter, but often dying back to the ground each year. Twigs smooth, greenish, containing a large pith.

Branches and petioles beneath usually armed with stout prickles up to .25 inch long, straight or nearly so with swollen base. Bark pale yellowish-brown, rough and rather deeply cracked. Blaze .3-.4 inch, pale yellow. Petiole up to 12 inches long, hollow, swollen at the base. Terminal leaflet 6—9 by 7—12 inches, ovate, broader than long, apex short acute, base truncate or rounded, margin entire or sinuate, glabrous, main lateral nerves 6—10 pairs, base 3-nerved, the petiolule up to 5 inches long with 2 large glands at the base. Lateral leaflets rather smaller, longer than broad, the petiolules with one large gland at the base. Inflorescence an erect axillary raceme 6—18 inches long, the purplish-brown rachis bearing flowers usually in threes along the uppermost third portion. Flowers scarlet 1.3—1.6 inches long. Pod 5—9 by .5 inch, flatish, gradually narrowed at both ends, clothed with short brown pubescence when young. Seeds 1—3 (F. B. 1 gives 4—6), black.

Occurs throughout the hills between 4,000 and 7,000 feet, but is local and generally scarce. Flowers: September-October.

2. *Erythrina suberosa*, Roxb. Vern. *Mandāra*, Gen. *Rungra*, EA.—A medium-sized deciduous tree attaining 6 feet girth and 60 feet high. The bark occurs in two forms, either form may be found on any tree to the exclusion of the other or both may be found on the same tree. In one type the bark is rough dark brown and corky with more or less deep vertical fissures. In the other type the dead corky tissue is replaced by a semi-transparent smooth yellowish gum about .1 inch thick. Blaze .5—1.25 inches, pale yellow but not fibrous towards the outside, pale orange-brown and fibrous towards the interior. Branches armed with prickles .1—.25 inch long, which are sometimes also present on the leaves. Petiole 4—8 inches long. Leaflets 4—6 inches long and broad, the terminal rhomboid-ovate, the lateral oblique, more or less glabrous above, densely downy beneath. Petiolules of the lateral leaflets .2—.5 inch long. Flowers scarlet, 1.5—2 inches long, in peduncled racemes 1—4 together near the ends of the branches. Pedicels .5 inch long in fascicles of 1—3. Pod 5.6 inches long, tapering at both ends, terete. Seeds 2—5, dull brown.

Occurs throughout the area between 1,000 and 4,500 feet. Common in dry miscellaneous forests. Flowers: March-April. Fruit: June.

3. *Erythrina glabrescens*, Parker. Syn. *Erythrina suberosa*, Roxb. Var. *glabrescens*, Prain.—This species has been described by Mr. R. N. Parker as follows:—"A small scraggy tree reaching in cultivation 50—60 feet by 5.6 feet girth; bark nearly smooth, reddish. Leaflets glabrous or very nearly so on both sides when mature. Standard 1.6—2 by .8—1 inch. Pod as in *E. suberosa* but somewhat flattened. Seeds bright red, polished. Otherwise as for *E. suberosa*."

The occurrence of these two species of *Erythrina* within our area requires further study. A specimen collected by Mr. R. St. G. Burke in the Lansdowne Division at 1,200 feet seems to be *E. glabrescens*.

18. SPATHOLOBUS, Hassk.

Climbing shrubs. Leaves pinnately 3-foliolate; stipules and stipels small. Flowers small, in large terminal panicles extending to the axils of the upper leaves. Calyx campanulate, the two upper teeth connate. Corolla exserted, the petals subequal, clawed; wings free; keel straight, obtuse, auricled above the claw. Stamens diadelphous. Ovary sessile or stalked, 2-ovuled, style incurved. Pod oblong, the base flat and indehiscent, the tip splitting round the single apical seed.

Spatholobus Roxburghii, Benth. Syn. *Butea parviflora*, Roxb. Vern. *Maula*, Gen.—A large sinistrorse climber, twining round supports with a close tight grip, the stem attaining 8 inches diameter and 80 feet high. Bark smooth (roughish on old stems) reddish-brown with prominent circular lenticels and often with numerous close regular horizontal wrinkles. Blaze .2—·5 inch, a narrow orange-coloured outer layer not fibrous, remainder pink, usually with a few dark purplish streaks, very fibrous. Petiole 3—8 inches long, swollen at the base. Leaflets obovate or elliptic, obtuse emarginate or abruptly acuminate, smooth dark green and glabrous above, smooth and ultimately glabrous or glabrescent beneath. Stalk of terminal leaflet .8—1·7 inches long, petiolules of the lateral .25—·4 inch. Terminal leaflet 6·5—11 by 5—7 inches; main lateral nerves prominent beneath, 7—10 pairs. Lateral leaflets about two-thirds of the terminal. Flowers .3-4 inch long, whitish, in large terminal panicles up to 3 feet long. Pedicels short, in fascicles of 3. Pod 3-4 by 1 inch, clothed with soft brown tomentum.

Occurs throughout the area up to 2,500 feet. Sometimes not uncommon in sal and miscellaneous forest. Flowers: September-October. Fruit: February-April.

19. BUTEA, Roxb.

Trees or climbing shrubs. Leaves pinnately 3-foliolate; stipules and stipels small. Flowers showy, densely fascicled in racemes or panicles. Calyx broadly campanulate, the 2 upper teeth connate. Corolla much exserted; standard equal to or shorter than the keel; wings adnate to the much incurved acute keel. Stamens diadelphous. Ovary sessile or shortly stalked, 2-ovuled; style incurved. Pod oblong, the base flat and indehiscent, the tip splitting round the single apical seed.

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|---|--------|----------------------|
| I.—A medium-sized tree flowering when leafless | ... | 1. <i>frondosa</i> . |
| II.—Shrubs flowering whilst in full leaf. | | |
| 1. Tomentum on leaves and other parts composed of rather long spreading hairs | ... | 2. <i>pellita</i> . |
| 2. Tomentum composed of short closely adpressed hairs | ... .. | 3. <i>minor</i> . |

1. *Butea frondosa*, Roxb. Vern. *Dhāk*, Gen.—A medium-sized deciduous tree attaining 7 feet girth and 40 feet high, usually with a short and crooked trunk. Bark somewhat rough, not deeply fissured, varying from pale brown to bluish-grey or blackish. Blaze .5 inch, very fibrous, whitish or pink finely streaked and veined with red except a narrow innermost layer, exuding a clear sticky red juice. Petiole 4—9 inches long, swollen at the base. Terminal leaflet 5—8 by 4.5—7 inches, broadly obovate from a cuneate base, or rhomboid, obtuse or retuse; the lateral leaflets oblique and slightly smaller; all coriaceous, glabrescent above, finely silky and conspicuously reticulate beneath. Petiolules .2-.3 inch long. Flowers 1.5—2 inches long, bright red tinged with orange, appearing when the tree is nearly leafless, in rigid axillary and terminal racemes 4—7 inches long. Pedicels .5—1 inch long, fascicled. Pod 4—8 by 1-2 inches, thin, flat, grey-silky, narrowed abruptly at the base.

Occurs in almost all parts of our area up to 4,000 feet. It is a gregarious species in the plains, but is usually sporadic within our area and is often common in open miscellaneous forest. Flowers: March-April. Fruit: June-July.

2. *Butea peltita*, Hook. f. Vern. *Patwa*.—A shrub with stout woody perennial rootstock from which several erect shoots up to 6 feet high and .75 inch diameter are annually produced. Stems ribbed, with a large pith. Leaves stems inflorescence and pods densely clothed with spreading white or pale brown tomentum. Leaves 18—30 inches long. Petiole 5—12 inches, furrowed above. Leaflets subequal, 9—20 by 6—14 inches, broadly ovate, the lateral pair somewhat oblique, entire, base truncate or obtuse, rather thick, lateral nerves 7—10 pairs. Petiolules .2—5 inch long. Stipules .5—1 inch long, ovate, acute or obtuse, base broad, subcordate, caducous. Stipels .4—7 inch long, narrowly lanceolate, acuminate. Flowers .9—1 inch long, in fascicles of usually 3 or 5, arranged in erect terminal and axillary simple racemes 6—15 inches long. Fascicles normally subtended by 1 bract and 3 bracteoles. Bracts .4-.5 inch long, triangular, caducous. Bracteoles linear, caducous. Calyx .4-.5 inch long, campanulate, thick, densely brown-tomentose: lobes 4, acute or obtuse. Corolla bright red, wings and keel changing to orange towards the base inside. Petals clothed outside with silky white hairs, glabrous within except the lower portion of the standard. Pedicels stout .3-.4 inch long. Pod 1.5—3 by .9—1.8 inches, oblong, coriaceous. Seed .5—8 inch diameter, compressed, glabrous, reddish-brown.

This species occurs more or less gregariously at 5,000 feet elevation around Patwadunga in the Naini Tal District and has also been collected from Kali Kumaon in East Almora. It is found on dry ridges and in open *chir* forest. Flowers: May-June.

3. *Butea minor*, Ham.—This plant is so similar to the last species that a separate description is unnecessary. It appears to differ only as follows. Leaves stems inflorescence and pods clothed more or less densely with short closely adpressed tomentum. Racemes simple or compound. Calyx 3—35 inch long.

It has been collected in the Kali valley, East Almora near Khela and below Dopata at about 4,000 feet elevation. Mr. R. N. Parker describes its habit as similar to that given for *B. pellita* though according to Dr. Prain in his account of these two species on page 385 of Kew Bull. for 1908 it is often a tall climber. I have some doubt in my own mind as to whether *B. pellita*, Hook. f. and *B. minor*, Ham. are specifically distinct.

20. PUERARIA, DC.

Climbing shrubs or herbs, sometimes with tuberous roots. Leaves pinnately 3-foliolate. Flowers purplish or blue, fascicled on the nodose rachis of long often compound axillary racemes. Calyx campanulate, teeth 5, the 2 upper connate. Corolla exserted; standard auricled above the claw; wings equalling the obtuse keel. Stamens monadelphous or distinctly diadelphous. Ovary subsessile, many-ovuled; style filiform, incurved. Pod linear, more or less flattened, continuous or septate within, sometimes jointed, dehiscent.

***Pueraria tuberosa*, DC.** Vern. *Sirāla*, G. *Bisālu*, A. *Birālu*, R and H.—A fairly large deciduous climber with large tuberous roots and extensive dextrorse stems attaining 5 inches diameter and 30 feet high. Bark pale brown, very rough, exfoliating in irregular loose strips. Blaze 3—5 inch, pinkish or yellowish, soft, fibrous, exuding a sticky pink juice. Petiole 4—12 inches long. Terminal leaflet 6—12 inches long and nearly as broad, broadly ovate from a cuneate base; lateral leaflets very oblique; all acuminate, silky when young, glabrescent above, adpressed grey-silky beneath when mature, margin sinuate, 3-nerved at the base or the lateral 4-nerved. Petiolules 2—5 inch long. Flowers 4—7 inch long, in lax, simple or paniculate, axillary or terminal racemes 6—12 inches long. Pedicels 1—2 inch long; fascicled. Calyx 25—3 inch long, very silky. Standard and keel white or tinged with violet, the standard with a pale yellow central spot, wings violet-blue becoming white towards the base. Pod 2-3 inches long, flat, constricted between the seeds, densely clothed with silky-bristly brown hairs.

Occurs in all parts of the area between 1,000 and 4,000 feet. Very common in dry miscellaneous and scrub forests, often completely covering bushes and small trees. Flowers: March-April, whilst leafless. Fruit: November-December.

21. ATYLOSIA, W. and A.

Herbs or shrubs, erect or twining. Leaves pinnately or rarely digitately 3-foliolate; leaflets with resinous glands beneath, often exstipellate.

Flowers usually yellow, axillary, in pairs or racemes. Calyx-tube campanulate, the lobes distinct. Corolla more or less exserted; standard auricled at base; keel slightly curved, obtuse. Stamens diadelphous. Ovary sessile; ovules 3 or more; style incurved, not bearded. Pod linear or oblong, septate, the valves more or less transversely or obliquely depressed between the seeds. Seeds with a conspicuous strophiole.

Flowers from February to March. Seeds 3—6 ... 1. *crassa*.

Flowers from September to October. Seeds 7—10 ... 2. *mollis*.

1. ***Atylosia crassa*, Prain.**—A dextrorse climber, the stem attaining 1·5 inches diameter and 40 feet high, branches wide-spreading. Petiole 1—3·5 inches long. Leaflets subequal, the lateral very oblique, the terminal usually rhomboid 1·5-4 by 1·4—3·7 inches, minutely pubescent above, densely yellow-or brown-pubescent beneath, base 3-nerved with 2-3 pairs above the basal. Stalk of terminal leaflet 1·2 inch long, petiolules of the lateral 0·5-1 inch long. Flowers yellow, 7·8 inch long, in axillary often paniced racemes 1—4 inches long, the buds hidden by conspicuous deciduous concave bracts 3—5 inch long. Pedicels 3 inch long, in pairs. Pod 1-1·8 by 4—6 inch with strong oblique furrows, yellow-glandular and densely brown-tomentose. Seeds 3—6.

Occurs up to 2,000 feet, chiefly in open miscellaneous forest but also with *sal*. Appears to be local and seldom common. It does not seem to enter the hills. Flowers: February-March.

2. ***Atylosia mollis*, Benth.**—A twining deciduous climber with densely branching stems 5—10 feet high. Petiole 8—2 inches long. Leaflets subequal, the lateral very oblique, the terminal usually rhomboid, 1·5—2·5 by 8—1·4 inches, minutely pubescent above, densely pubescent beneath, base 3-nerved with 2-3 pairs above the basal. Stalk of terminal leaflet 1·2 inch long, petiolules of the lateral 0·5—1 inch long. Flowers yellow, 9—1 inch long, in axillary racemes 5—1·5 inches long. Pedicels 4—6 inch long, singly or in pairs. Pod 1·2-1·75 by 3·4 inch with strong slightly oblique furrows, yellow-glandular and densely brown-tomentose. Seeds 7—10.

Occurs between 3,000 and 5,000 feet in valleys of the central hill ranges where it is fairly common in miscellaneous scrub forest. It does not appear to be found in the foot hills with *A. crassa*. Flowers: September-October. Fruit: November-December.

22. RHYNCHOSIA, Lour.

Twining or erect herbs or shrubs. Leaves pinnately or sometimes subdigitately 3-foliolate; leaflets gland-dotted beneath, with or without stipellæ. Flowers in axillary racemes, solitary or in pairs on the rachis, rarely solitary. Calyx-tube short, lobes subequal, the 2 upper more or less connate, not or only slightly accrescent. Corolla included

or exserted; standard with inflexed auricles at the base. Stamens diadelphous. Ovary subsessile, usually 2-rarely 1-ovuled; style much incurved. Pod round or oblong, more or less compressed, continuous or septate within, dehiscent. Seeds 2, rarely 1; strophiole usually present.

An erect shrub	...	...	...	...	1. <i>Pseudo-cajan</i> .
A small climber	...	...	...	...	2. <i>sericea</i> .

1. *Rhynchosia Pseudo-cajan*, Camb.—An erect evergreen shrub 4–8 feet high, the stems attaining .75 inch diameter. Bark smooth, greenish. Twigs striate, grey-tomentose. Leaves pinnately trifoliate. Petiole .5–1.5 inches long. Terminal leaflet 1–3 by .6–1.8 inches, rhomboid, ovate or suborbicular; lateral leaflets smaller, oblique; all entire or with sinuate margin, minutely pubescent above, grey-tomentose with prominent nerves beneath, basal nerves 3 with an additional much smaller pair. Petiolules up to .1 inch long. Flowers .5 inch long, yellow, in dense axillary racemes 1–3 inches long. Pedicels .1–.2 inch long. Pod 1 by .3–.4 inch, straight, hard, grey-tomentose. Seeds 1–2.

Occurs throughout the hills between 2,500 and 6,000 feet. Generally scarce, usually in *chir* forest, sometimes on steep almost bare slopes. Flowers: April–June.

2. *Rhynchosia sericea*, Spanoghe.—A small deciduous dextrorse climber with slender spreading branches clothed with sticky glandular hairs. Leaves pinnately trifoliate. Petiole 1.5–4 inches long. Terminal leaflet 1.5–3 by 1–2.25 inches, rhomboid or suborbicular; the lateral very oblique; all abruptly short-acuminate, glandular-pubescent on both surfaces, margin sinuate, 3-nerved. Petioles .1 inch long. Flowers .7 inch long, dark red, in lax axillary pedunculate racemes 8–12 inches long. Pedicels minute. Calyx with sticky glandular hairs. Pod 1–1.2 by .2–.3 inch, turgid, pubescent. Seeds 2.

Occurs in the central and inner hill ranges between 2,000 and 5,500 feet. Locally common in open scrub forest and on grassy slopes. The slender stems appear in some cases to be annual. Flowers: July–September. Fruit: October–November.

23. FLEMINGIA, Roxb.

Shrubs or undershrubs, rarely herbs, erect or trailing. Leaves 1-foliate or digitately 3-foliate; leaflets gland-dotted beneath, exstipellate. Flowers in simple or compound racemes panicles or sometimes heads. Calyx-tube short, teeth subequal or the lowest the longest. Corolla little or not exserted; standard auricled at base; wings adnate to the keel. Stamens diadelphous. Ovary subsessile, 2-ovuled. Pod small, oval, very inflated, without septa, dehiscent, usually 2-seeded. Seeds rounded, estrophiole.

I.—Leaves simple.

A. Flowers in small clusters hidden by large reniform persistent bracts.

1. Leaves sub-orbicular, elliptic or ovate ... 1. *fruticulosa*,

2. Leaves ovate-lanceolate.
 - (a) An erect shrub 4—10 feet high ... 2. *strobilifera*.
 - (b) An erect undershrub 1·2 feet high ... 3. *bracteata*.
 - B. Flower-clusters subtended by small lanceolate caducous bracts ... 4. *paniculata*.
- II.—Leaves trifoliolate.
- A. Petiole usually exceeding 4 inches.
 1. Secondary nerves 12—22 pairs, the basal not conspicuously larger ... 5. *stricta*.
 2. Secondary nerves 5—8 pairs, the basal conspicuously larger ... 6. *nana*.
 - B. Petiole not exceeding 4 inches.
 1. Stems erect, perennial, 4—10 feet high ... 7. *semialata*.
 2. Stems erect or suberect, mainly annual, not exceeding 3 feet high ... 8. *prostrata*.

I have not included *F. procumbens*, Roxb., though reported to occur in the Kalgargh Division, for want of confirmation. This species has trailing rather weak stems up to 24 inches long. Leaves trifoliate, the leaflets subequal, the terminal one obovate and 5—1·5 inches long. The flowers are in short axillary racemes, and the calyx and pods are beset with garnet-coloured glands as in *F. nana*.

1. *Flemingia fruticulosa*, Wall.—A deciduous procumbent undershrub, the trailing stems wholly or partly dying back each year, up to 12 inches long and 1·5 inch diameter. Leaves simple, 1—4 inches long, suborbicular, elliptic or ovate, base cordate, entire, glabrescent above, paler and hairy on the nerves beneath; lateral nerves 3—5 pairs. Petiole 1·2 inch long. Flowers pink, 4 inch long, in small clusters hidden by large folded reniform membranous bracts, arranged distichously. Bracts strongly nerved, broader than long, up to 1 by 1·25 inches. Pod 3 inch long, turgid, pubescent. Seeds 2.

Occurs throughout the hills between 3,000 and 8,500 feet. Very common on open grassy slopes in *chir* and *banj* forest. The new leaves are often a coppery-brown colour. Flowers: August—April. Fruit: December—May.

2. *Flemingia strobilifera*, R. Br.—An erect evergreen shrub 4—10 feet high with stems up to 1·25 inches diameter. Bark reddish-brown, slightly rough owing to numerous small lenticels. Twigs striate, thinly hairy. Blaze fibrous. Leaves simple, ovate-lanceolate, acute, base rounded, 5—7·5 by 1·75—3 inches, glabrous on the upper surface except the midrib which is clothed with adpressed rusty hairs, pubescent and more or less covered with red glands beneath; main lateral nerves 7—11 pairs, prominent beneath. Petiole 3—1·5 inches long. Stipules 5—7 inch long, linear, acuminate. Flowers greenish-white, hidden within membranous persistent bracts, in terminal racemes 2—5 inches long. Bracts as in *F. bracteata* but glabrescent and attaining 1·5 inches long. Pod 3·4 inch long, turgid, finely downy. Seeds 2.

Occurs in the subhimalayan tract up to 2,000 feet but appears to be scarce. It grows in moist localities bordering forest streams. Flowers: April-May.

3. *Flemingia bracteata*, Wight.—An erect undershrub 1·2 feet high, the stems not exceeding 2 inch diameter. Twigs triquetrous,

clothed with adpressed ferruginous hairs. Leaves simple, ovate-lanceolate, acute, base rounded or cordate, 3·5—6·5 by 1·5—2·5 inches, entire, thin, upper surface rather glossy and glabrous or with scattered hairs on the main nerves, lower surface more or less pubescent on the nerves; basal nerves usually 3 sometimes 5; main lateral nerves including the basal 6—8 pairs, prominent beneath. Petiole 2—9 inch long. Stipules 4—7 inch long, scarious, narrowly lanceolate, persistent. Flowers pale yellowish tinged with pink, 25—3 inch long, clustered usually 2 together and hidden within membranous persistent bracts, in axillary or terminal simple or paniced racemes 2—4 inches long. Bracts cordate, reniform, 4—1 inch long, arranged plicately and distichously on the rachis, clothed on the outside with long spreading hairs. Pod 25—4 inch long, turgid, pubescent. Seeds 2.

Occurs in the Bhabar tract and outer hill ranges between 1,000 and 2,500 feet. Common in *sal* forest. Flowers: October—January. Fruit: November—February.

4. *Flemingia paniculata*, Wall.—An erect evergreen shrub, 1·5—2·5 feet high, with stems up to 4 inch diameter. Bark fairly smooth, reddish-brown with scattered lenticels. Twigs terete, clothed with long spreading hairs. Leaves simple, 4—8 by 2·5—4·5 inches, ovate, base rounded or cordate, upper surface glabrescent except along the main nerves, lower surface more or less hairy on the nerves and glabrescent or with scattered hairs between; base 5-nerved with 6—8 pairs above the basal, prominent beneath. Petiole 5—2 inches long, clothed with pale spreading hairs. Stipules 3—7 inch long, scarious, narrowly lanceolate, persistent. Flowers 25 inch long, pinkish-yellow, in lax axillary and terminal paniced racemes. Pod 5 inch long, oblong, finely downy. Seeds 2.

Occurs in the Bhabar tract between 1,000 and 2,500 feet. Fairly common in shady *sal* forest, especially in ravines. Flowers: February—April.

5. *Flemingia stricta*, Roxb.—An erect, sparingly branched shrub 4—10 feet high, the stem attaining 5 inch diameter. Bark smooth, reddish-brown with small scattered circular lenticels. Twigs triquetrous, clothed with scattered adpressed hairs. Leaves digitately trifoliate. Petiole 3—8 inches long, narrowly winged (*Duthie* says not winged). Terminal leaflet 6—16 by 2—6 inches, oblong, acuminate, glabrous above, hairy on the veins beneath; main lateral nerves conspicuous, 12—22 pairs. Stipules 1·5—4 inches long, lanceolate, caducous. Undersurface of leaves, petiole, stipules and young shoots with scattered black glands. Flowers purplish, veined, 25—35 inch long, in dense often fascicled axillary racemes 2—4 inches long, conspicuous in bud by the densely imbricating brown linear-lanceolate bracts which conceal the buds. Pod 4·5 inch long, glabrescent or hairy.

Occurs in the Bhabar tract up to 2,000 feet. Rather scarce. Found in moist localities and along the banks of forest streams. Flowers: March-April.

6. *Flemingia nana*, Roxb.—An undershrub with erect or sometimes procumbent annual stems from a woody base. Stems 3—18 inches long and not exceeding $\frac{1}{4}$ inch diameter. Young shoots triquetrous. Leaves trifoliolate. Petiole 4—9 inches long, sharply 3-angled and narrowly winged. Stalk of terminal leaflet $\frac{2}{3}$ inch long. Terminal leaflet $\frac{4}{5}$ —9 by $\frac{3}{25}$ —6 inches, obovate, upper surface clothed with short hairs, lower surface hairy on the nerves and with garnet-coloured glands between. Stipules $\frac{1}{5}$ — $\frac{7}{5}$ inch long. Flowers $\frac{2}{5}$ — $\frac{3}{5}$ inch long, pink, in crowded, shortly-peduncled racemes. Calyx green, $\frac{1}{2}$ inch long, covered with garnet-coloured glands. Pod $\frac{3}{4}$ inch long, beset with garnet-coloured glands which often turn black with age.

Occurs in the Bhabar tract between 1,000 and 2,000 feet. Not uncommon locally in *sal* forest, and sometimes on fire lines. Flowers: February-March.

7. *Flemingia semialata*, Roxb.—An erect subdeciduous shrub 4—10 feet high, with stems up to $\frac{1}{2}$ inches diameter. Bark smooth, reddish-brown with minute pale circular lenticels. Twigs coarsely ribbed, densely grey-hairy. Leaves digitately trifoliolate. Petiole 1—4 inches long, triquetrous and narrowly winged. Terminal leaflet $\frac{3}{5}$ —7 by $\frac{1}{75}$ — $\frac{3}{5}$ inches, narrowed from the middle to a small rounded base, acuminate, thin, entire, hairy on the nerves on both surfaces, 3-nerved. Lateral leaflets smaller, oblique, 4-nerved. Petiolules $\frac{1}{2}$ — $\frac{3}{4}$ inch long. Flowers $\frac{4}{5}$ inch long, greenish-pink, in axillary and terminal often branched racemes 1—5 inches long. Pod $\frac{4}{5}$ —6 inch long, turgid, downy. Seeds 1-2, shining, black, globose.

Occurs throughout the area between 1,000 and 6,000 feet. It is a highly gregarious shrub, sometimes forming a dense undergrowth over large areas of *sal* forest. Very common. Flowers: August—October. Fruit: December—February.

8. *Flemingia prostrata*, Roxb.—A deciduous undershrub with erect or suberect stems $\frac{1}{2}$ —3 feet high and up to $\frac{1}{4}$ inch diameter. The stems are usually annual, but exceptionally persist. Shoots sharply triquetrous and densely grey-hairy when young. Leaves digitately trifoliolate. Petiole $\frac{1}{5}$ — $\frac{2}{5}$ inches long, widening upwards, narrowly winged. Stipules $\frac{1}{2}$ — $\frac{6}{5}$ inch long, silky, linear, persistent. Terminal leaflet $\frac{2}{5}$ —6 by $\frac{1}{75}$ — $\frac{2}{5}$ inches, narrowly lanceolate, entire, rather thick, minutely hairy above becoming dense along the midrib, more or less pubescent beneath. Lateral leaflets smaller, oblique. Upper leaf-surface with much depressed venation which is conspicuously raised beneath. Petiolule $\frac{1}{4}$ inch long or less. Flowers $\frac{1}{2}$ — $\frac{2}{5}$ inch long, pink tinged with green, in congested axillary racemes about as long as the petioles, or less. Pod $\frac{3}{4}$ inch long, turgid, adpressed-hairy. Seeds 1-2, globose, brown mottled with green.

Occurs throughout the area between 1,000 and 5,500 feet. Common in *sal* forests and grassy blanks of the Bhabar tract. Flowers: July—September. Fruit: November—February.

24. DALBERGIA, *Linn. f.*

Trees or shrubs, often climbing. Leaves imparipinnate or rarely 1-foliolate; leaflets alternate, usually 5 or more, exstipellate. Flowers small, in simple or paniced cymes. Calyx campanulate; teeth short. Corolla exserted; wings oblong, free; keel obtuse, the petals joined at the tip. Stamens monadelphous (9 or 10) or diadelphous (5 plus 5 or rarely 9 plus 1). Ovary stalked; ovules few; style incurved, short. Pod thin, flat, usually oblong and veined opposite the seeds, indehiscent. Seeds 1—4.

I.—A climber or sarmentose shrub 1. *volubilis*.

II.—Trees.

1. Leaflets 3—5	...	...	...	2. <i>Sissoo</i> .
2. Leaflets 7—17	...	...	...	3. <i>lanceolaria</i> .
3. Leaflets 17—25	...	...	...	4. <i>sericea</i> .

1. **Dalbergia volubilis**, *Roxb.*—A deciduous rambling climber or sometimes a suberect shrub with drooping branches, the stem attaining 12 inches diameter and 100 feet high. Bark rough, pale brown. Blaze 2 inch, white rapidly turning deep reddish-brown on exposure. Leaves imparipinnate; rachis 4—8 inches long. Leaflets 9—13, opposite or alternate, 7—2 inches long (sometimes attaining 3 inches), obovate or ovate-oblong, very obtuse or emarginate, apiculate, nearly glabrous. Petiolule 1·2 inch long. Flowers 25 inch long, pale blue or lilac, in copious terminal and axillary panicles with adpressed-pubescent or rusty-tomentose horizontal or decurved branches up to 6 inches long. Pod 2·3 by 8—1 inch, stalked, narrowed at both ends, flexible, glabrous. Seeds 1·2, usually 1.

Occurs in the Bhabar and outermost hill ranges between 1,000 and 2,000 feet, but not recorded west of Haldwani. Flowers: January—March.

2. **Dalbergia Sissoo**, *Roxb.* Vern. *Shisham*, Gen. Eng. *Sissu*.—A medium-sized deciduous tree. Bark rough with shallow broad longitudinal fissures, exfoliating in irregular woody strips and scales, pale grey or light brown. Blaze 8—1·1 inches, very fibrous, pale yellow rapidly turning first orange then dark reddish-brown on exposure. Leaves imparipinnate; rachis 1·5—3 inches long, swollen at the base. Leaflets 3—5, alternate, 1·5—2·5 inches long, broadly ovate or suborbicular, abruptly acuminate, glabrescent, entire, base rounded truncate or cuneate; petiolules 1·2 inch long. Flowers 2·3 inch long, pale yellowish-white, sessile or nearly so, in axillary panicles shorter than the leaves. Pod 1·5—4 by 3—5 inch, thin, flat, glabrous. Seeds 1—4, flattened.

Occurs in all parts of the area up to 3,000 feet. It is a gregarious species characteristic of riverain tracts and is seldom found away from the banks of rivers and streams. Flowers: March—May. Fruit: January—March.

3. *Dalbergia lanceolaria*, Linn.—A moderate-sized deciduous tree. Bark pale grey, fairly smooth, covered with minute pale lenticels, exfoliating in irregular thin woody scales. Blaze 4—7 inch, not or scarcely fibrous, orange-yellow rapidly turning reddish-brown on exposure, tinged green with chlorophyl beneath the thin outer dead tissue. Leaves imparipinnate; rachis 3—9 inches long. Leaflets 7—21 alternate, 1.25 by .6—1.5 inches, oblong elliptic or obovate-oblong, apex emarginate, base obtuse or rounded, rigidly subcoriaceous, pale and rather glaucous beneath, with scattered short hairs on the undersurface or on both surfaces when young. Flowers dull white or pinkish, .3-.4 inch long, unilateral on the spreading branches of large lax axillary and terminal pubescent panicles 2—4 inches long. Pod 2—5 by .5—8 inch, stalked, narrowed at both ends, flexible, glabrous. Seeds 1—4.

Occurs in dry miscellaneous forests of the Bhabar tract between 1,000 and 2,000 feet but is scarce. Flowers: May-June. Fruit: February-March.

4. *Dalbergia sericea*, G. Don. Vern. *Gūgar*, G and A. *Bhandir*, G.—A medium-sized deciduous tree attaining 7 feet girth and 60 feet high. Bark dark brown or grey, rough, exfoliating in irregular woody scales. Blaze .3-.4 inch, somewhat fibrous, pale yellow or orange rapidly turning orange-brown on exposure. Twigs rusty-tomentose. Leaves imparipinnate; rachis 6—10 inches long. Leaflets 17—25, alternate, 1—1.5 by .6—.9 inch, ovate or elliptic, obtuse or emarginate, clothed on both surfaces with adpressed pubescence. Flowers pale lilac or whitish, .25 inch long, in congested axillary panicles 1-2 inches long. Pod 1-2 by .2-.3 inch, stalked, flat, linear, glabrous. Seeds 1—3.

Occurs throughout the area between 2,000 and 5,000 feet. Almost always found growing on the banks of streams, or less frequently on landslips. Fairly common. Flowers: April-May. Fruit: November—February.

25. PTEROCARPUS, Linn.

Trees. Leaves imparipinnate; leaflets alternate, usually coriaceous, exstipellate. Flowers yellowish, in racemes or panicles. Calyx-tube campanulate, curved in bud, teeth short. Corolla exserted, the petals all long-clawed; standard and wings crisped on the margin; keel petals smaller, slightly connate. Stamens diadelphous (5 plus 5 or 9 plus 1) or monadelphous with the sheath slit above only. Ovary sessile or stalked; ovules 2—6. Pod orbicular, compressed, with a broad wing, the apex displaced to near the base. Seeds 1, rarely 2.

Pterocarpus Marsupium, Roxb. Vern. *Bijē-sal*, H. *Bipa-sal*, A.—A tall or medium-sized deciduous tree. Bark roughish, ashy-grey. Blaze .5—7 inch, pale yellow with numerous pink streaks from which

a copious bright red gum exudes, and with occasional dark grey lines. Leaves imparipinnate, 7—10 inches long. Leaflets 5—7, alternate, 1·5—5 by ·75—3 inches, ovate or ovate-oblong, acute or shortly acuminate, coriaceous, glabrous above, densely clothed beneath with short adpressed hairs when young, becoming sparsely hairy or glabrescent when mature; lateral nerves 15—22 pairs close parallel and rather prominent beneath. Petiolule ·2—·35 inch long. Flowers yellowish, ·5 inch long, in large much-branched terminal panicles 6—10 inches long. Pedicels ·1 inch long. Pod orbicular, with a broad rigid wing, the apex displaced to one side, 1-2 inches diameter. Seed 1.

Occurs in the Bhabar and subhimalayan tract up to 2,000 feet. Not recorded west of Haldwani. Flowers: June—August. The species here described is var. *acuminata*, Prain.

26. SOPHORA, Linn.

Trees or shrubs. Leaves imparipinnate; leaflets opposite or sub-opposite, with or without stipels. Flowers showy, yellow or purple, in terminal racemes or panicles. Calyx-tube widely campanulate; teeth short. Corolla much exserted, the petals clawed; standard broad; wings sagittate above the claw. Stamens 10, free or nearly so. Ovary stipitate, many-ovuled. Pod moniliform, dehiscent or indehiscent, joints turgid, sometimes winged.

***Sophora mollis*, Grah.**—An erect deciduous shrub 4—8 feet high, with stems up to ·5 inch diameter. Bark quite smooth, green. Shoots finely grey-pubescent or downy. Leaves imparipinnate, 5—10 inches long. Leaflets 21—45, opposite or alternate, ·5—1 inch long, ovate or oblong, obtuse, entire, more or less sparsely downy on both surfaces. Petiolule ·05 inch long. Flowers bright yellow, ·8—1 inch long, scented, appearing shortly before the leaves, in axillary racemes 2—4 inches long. Pedicels ·3-·4 inch long. Pod 3—5 inches long; joints 5—10, 1-seeded, more or less distinctly constricted between the seeds, 4-winged, glabrous when mature.

Occurs throughout the hills between 1,500 and 4,000 feet. It appears to be rather scarce and is usually found in open miscellaneous forest. Flowers: February—April.

Sub-family II.--Caesalpinioideæ.

Trees or shrubs sometimes climbing, rarely herbs. Leaves 1-2-pinnate, usually with many leaflets, sometimes reduced to 1 pair which are sometimes more or less connate; stipels none or rarely minute. Flowers zygomorphic, rarely regular, hermaphrodite, usually racemose. Calyx-lobes usually 5 or 4 from union of the upper pair, or very rarely gamosepalous, imbricate, rarely valvate. Petals usually 5, rarely fewer or 0, the upper innermost in bud, the others imbricate. Stamens 10 or fewer by abortion, rarely numerous; filaments usually free. Ovary free or on a stalk which is more or less adnate to the disk. Pod dehiscent or indehiscent, often septate.

•I.—Leaves bipinnate.

- | | | | |
|---|-----|-----|------------------------|
| 1. Pod not winged. Leaflets not exceeding 1·5 inches long | ... | ... | 1. <i>Cæsalpinia</i> . |
| 2. Pod winged along the upper suture. Leaflets exceeding 1·5 inches | ... | ... | 2. <i>Mezoneurum</i> . |

•II.—Leaves pinnate.

- | | | | |
|---|-----|-----|------------------------|
| 1. Leaflets less than 10 pairs, exceeding 1·5 inches long | ... | ... | 3. <i>Cassia</i> . |
| 2. Leaflets 10—20 pairs, 5—7 inch long | ... | ... | 4. <i>Tamarindus</i> . |

III.—Leaves simple, mostly 2-lobed at the apex

...	5. <i>Bauhinia</i> .
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1. CAESALPINIA, Linn.

Trees, shrubs or climbers, armed or unarmed. Leaves bipinnate; stipules various; stipels 0 or converted into thorns. Flowers often showy, yellow or red, in racemes or panicles. Calyx of 5 sepals, the lowest concave outermost. Petals 5, broad, clawed, the uppermost smallest. Stamens 10, free, declinate. Ovary sessile, few-ovuled. Pod oblong or ovoid, flattened or turgid, sometimes spiny.

Pedicels 2 inch long. Pod prickly	1. <i>Bonducella</i> .
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Pedicels 5—1·2 inches long. Pod smooth	2. <i>sepiaria</i> .
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1. **Cæsalpinia Bonducella**, *Flem.* Vern. *Karaunj*, R.—A large rambling climber, the stem attaining 4 inches diameter and 60 feet high, or sometimes a shrub with scrambling wide-spreading branches. Bark pale brown to blackish, fairly smooth but roughened by the presence of conspicuous raised lenticels and prickles. Prickles nearly straight, up to 5 inch long, raised on a woody spreading base up to 6 inch across. Blaze 2—4 inch, fibrous, pink or reddish. Leaves 12—18 inches long; rachis with 1-2 recurved prickles at the base of each pinna

and scattered straight or recurved prickles between the pinnæ; pinnæ 6—8 pairs, opposite, 2—6 inches long. Leaflets 6—10 pairs on each pinna, opposite, 7—1·5 inches long, elliptic-oblong, obtuse, more or less puberulous especially beneath. Flowers yellow, 5—7 inch diameter, in supra-axillary and terminal pedunculate racemes 6—12 inches long. Petals oblongate, the upper spotted with orange. Pedicels 2 inch long in flower. Pod 2-3 by 1·5—2 inches, densely covered with wiry prickles. Seeds 1-2, lead-coloured, shining, more or less globose, 5—7 inch long.

Occurs in the subhimalayan tract and low valleys in the outer ranges up to 3,000 feet. Not uncommonly found in miscellaneous forest, especially scrub areas near cultivation. Flowers: July—September. Fruit: February—April.

2. *Cæsalpinia sepiaria*, Roxb. Vern. *Kingari*, NG. *Airi*, NG and RK.—A large rambling deciduous climber, the stem attaining 4 inches diameter and 45 feet high, or sometimes a shrub with scrambling wide-spreading branches. Bark dark brown or blackish, slightly rough with conspicuous circular lenticels and prickles. Prickles sharp, nearly straight, up to 75 inch long, raised on a spreading woody base up to 75 inch across. Blaze 3·4 inch; crisp, pale orange or yellow densely mottled with orange-brown. Leaves 9—15 inches long; rachis armed with recurved prickles at the junction of and between the pinnæ; pinnæ 5—10 pairs, opposite, 2—4 inches long. Leaflets 8—12 pairs, opposite, 6—8 by 2—4 inch, oblong; very obtuse at both ends, usually glabrous above, puberulous beneath. Flowers yellow, 8—1·1 inches diameter, in simple terminal and axillary racemes 10—16 inches long. Petals suborbicular, the upper with a few red streaks. Pedicels 5—1·2 inches long. Pod 2·5-4 by 8—1·1 inches, glabrous, smooth. Seeds 4—8, ovoid, 4 inch long, smooth, mottled brown and black.

Occurs throughout the hills between 2,000 and 7,000 feet. Common, chiefly in ravines. Flowers: March-April. Fruit: October-November.

2. *MEZONEURUM*, Desf.

Woody climbers, armed. Leaves abruptly bipinnate; stipules small or 0; stipels 0. Flowers in axillary or terminal paniced racemes. Calyx very oblique. Petals 5; 4 orbicular, spreading, subequal; the uppermost different. Stamens 10, free, declinate, exserted. Ovary sessile or shortly stalked, 2-many-ovuled. Pod oblong, flat, thin, indehiscent, broadly winged along the upper suture.

***Mezoneurum cucullatum*, W. and A.**—A fairly large rambling glabrous climber with stems up to 3 inches diameter and 50 feet high. Bark fairly smooth; brown. Stems bearing slightly recurved dark brown or black prickles up to 35 inch long, also scattered more or less in

pairs along the leaf-rachis. On old stems they are seated on a broad-based woody pedestal up to .8 inch high. Blaze .1-.2 inch, hard outside fibrous inside, pinkish-brown stippled with darker orange. Leaf-rachis 6—14 inches long; pinnæ 2—6 pairs; rachis and pinnæ slender, terete. Leaflets 4-5 pairs on each pinna, opposite, 1.5—3.5 by .9—1.5 inches, ovate or elliptic, entire, acute or acuminate, base rounded or acute, rigidly subcoriaceous, dark glossy green above, pale beneath; lateral nerves indistinct. Petiolule .1 inch long. Flowers .9 inch long including the stamens, in rigid racemes 4—10 inches long, usually arranged in terminal and axillary panicles, often from the old wood. Rachis yellow. Pedicels .3-.4 inch long, jointed about the middle. Calyx deeply cleft, bright yellow; the 2 anterior lobes connate and boatshaped, .35 inch long, obtuse. Corolla yellowish-green fading pink, the posterior petal darker green, 2-lobed and shorter. Filaments yellow, sparsely hairy at the base; anthers red. Pod 2—4 by .9—1.2 inches (including the wing), one-seeded.

Has been collected near Senapani in the Haldwani Division where it grows in moist miscellaneous forest at 700 feet elevation. Flowers: November-December.

3. CASSIA, *Linn.*

Trees, shrubs or herbs. Leaves paripinnate, exstipellate. Flowers usually yellow, often showy, in axillary racemes, terminal panicles or supra-axillary fascicles of 1 or more. Calyx-tube very short; lobes 5. Petals 5, imbricate, subequal or the lower the largest. Stamens normally 10 but rarely all perfect and equal, 3—5 (usually the uppermost) being sometimes wanting or reduced to staminodes. Ovary sessile or stalked, many-ovuled; style incurved. Pod variable in shape, usually septate, dehiscent or not.

I.—A tree. Pod 1-2 feet long 1. *Fistula*.

II.—Shrubs or herbs. Pod 3—5 inches long.

1. Leaves with a solitary gland near the base of the petiole 2. *occidentalis*.
2. Leaves with glands on the rachis between the leaflets 3. *levigata*.

1. *Cassia Fistula*, *Linn.* Vern. *Simāra*, SG. *Amaltās*,

Gen.—A small or medium-sized subdeciduous tree attaining 5 feet girth and 60 feet high. Bark of stems up to middle age quite smooth, pale greenish-grey, occasionally with long deep vertical fissures. Bark of mature stems dark grey, rough, exfoliating in small thick woody scales. Blaze .5—7 inch, soft, shortly fibrous, pink, the juice turning purple on the blade of a knife. Leaves .9—18 inches long. Leaflets 4—8 pairs, 2—6 by 1.5—3 inches, ovate or ovate-oblong, usually acute or somewhat acuminate, glossy and glabrous above, pubescent beneath when

young; lateral nerves numerous, prominent beneath. Petiolules .2—.3 inch long. Flowers yellow, 2 inches across, in lax drooping axillary racemes 12—24 inches long. Pedicels 1-2 inches long, slender, spreading. Pod 1-2 feet long, and 1 inch diameter, cylindric, smooth, pendulous, nearly black when ripe. Seeds 40—100, flat, about .4 inch diameter, immersed in a dark-coloured sweetish pulp which dries up as the pod ripens.

Occurs throughout the area up to 4,000 feet, except the innermost valleys. Abundant in the Bhabar tract, especially in miscellaneous forest, but also common in many *sal* areas. Flowers: April—June. Fruit: April-May.

2. *Cassia occidentalis*, Linn.—An erect herb or shrub 2—5 feet high, mostly annual and herbaceous, but a short basal portion sometimes persisting, attaining .75 inch diameter and becoming quite woody. Branches not hollow. Bark smooth, brown. Leaf-rachis 4—6 inches long, deeply grooved above and bearing a large tumid gland near the base. Stipules .3-.4 inch long, semicordate, green mottled with pink, caducous. Leaflets 3—5 pairs, 1.5—5 by .75—1.5 inches, the terminal pairs oblong-lanceolate tapering to an acute tip, the basal ovate and smaller, entire, base rounded and unequal, glabrous except for the ciliolate margin, dull unglossed green on both surfaces, paler beneath. Petiolules up to .1 inch long. Flowers yellow, .5—.75 inch diameter, in axillary and terminal sometimes panicle racemes. Pedicels .2—.3 inch long in flower. Bracts .7—1 inch long, lanceolate, green mottled with pink. Calyx yellowish-green mottled with pink. Corolla uniformly bright yellow. Pod slightly falcate, compressed, 4—5 by .3—.35 inch. Seeds 20—30, .15 inch long, smooth, brown.

Occurs throughout the subhimalayan tract also valleys in the hills up to 4,000 feet. Fairly common on waste lands and roadsides. The whole plant is foetid. The seeds have been used as a substitute for coffee. Flowers: July—September. Fruit: August—October.

3. *Cassia lævigata*, Willd. Vern. *Tarōr*, G.—An erect shrub with stem up to 8 feet high and 1.5 inches diameter. Bark smooth with numerous small lenticels. Branches smooth, green and hollow. Leaf-rachis 3—6 inches long, deeply grooved above and bearing a prominent gland between each pair of leaflets except the terminal. Leaflets 3-4 pairs, 1.75—4.5 by .75—1.75 inches, the terminal pairs elliptic-oblong the basal more ovate and smaller, acuminate, entire, base obtuse or rounded, glabrous, glossy dark green above and glaucescent beneath. Petiolule .05—.1 inch. Flowers yellow, 1.2—1.5 inches diameter in axillary or terminal, simple or branched, glabrous, pedunculate racemes 1.5—3 inches long. Pedicels .6—.7 inch long. Pod shortly but distinctly stalked, straight, cylindric, 3—4 by .5 inch, apiculate, glabrous. Seeds numerous, dark brown, compressed.

This plant is indigenous to America but is found cultivated round villages throughout the hills between 3,500 and 5,500 feet on account of the pod which is eaten as a vegetable. In many localities in scrub forest and on waste ground it has become naturalised. Flowers: June—November. Fruit: November–December.

4. TAMARINDUS, *Linn.*

A tree. Leaves paripinnate; leaflets many, small, exstipellate. Flowers in racemes. Calyx-tube turbinate; lobes 4, imbricate. Petals 3, imbricate, the two lower reduced to scales. Stamens 3 perfect, the filaments connate about half-way up in a sheath split above, the rest reduced to bristle-like staminodes. Ovary stipitate, the stalk adnate to the disk, many-ovuled. Pod linear, curved, thick, somewhat compressed, with brittle epicarp, pulpy mesocarp and leathery septate endocarp, indehiscent.

Tamarindus indica*, *Linn. Vern. *Amli*, R. *Imli*, H. Eng. The Tamarind.—A medium-sized evergreen tree up to 6 feet girth and 50 feet high. Bark dark grey, roughish, exfoliating in irregular hard scales. Blaze 3—5 inch, very fibrous inside, hard, pink. Leaves 3—6 inches long. Leaflets 10—20 pairs, opposite, 5—7 by 15—2 inch, oblong, obtuse, glabrescent. Flowers about 5 inch long, pale yellow striped with red, in lax few-flowered racemes terminating short lateral shoots. Pod 3—8 by 8—1 inch. Seeds dark brown or black, irregularly shaped, embedded in a dark brown pulp.

This species is not indigenous, but has been naturalised and is often planted along roads. Found in the subhimalayan tract. Flowers: May–June. Fruit: March–April.

5. BAUHINIA, *Linn.*

Trees or shrubs, erect or climbing, the latter often with circinate tendrils. Leaves of two leaflets, free or more usually adnate into one entire leaf more or less deeply cleft at the apex. Flowers more or less zygomorphic. Calyx-tube cylindric or turbinate; limb entire and spathaceous with 5 teeth or cleft into lobes. Petals 5, slightly unequal, usually clawed, the upper petal innermost. Stamens 10 or reduced to 5 or 3 or even 1 fertile, the rest sterile or wanting; filaments free. Ovary stalked, many-ovuled. Pod linear or oblong, coriaceous or woody, dehiscent or not.

I.—Trees.

A. Fertile stamens 10; pod indehiscent.

- | | |
|---------------------------------------|----------------------------|
| 1. Leaves not acid; calyx spathaceous | ... 1. <i>racemosa</i> . |
| 2. Leaves acid; calyx 5-cleft | ... 2. <i>malabarica</i> . |

B. Fertile stamens 3—5; pod dehiscent.

- | | |
|---|---------------------------|
| 1. Leaves entire or notched at the apex | ... 3. <i>retusa</i> . |
| 2. Leaves cleft. | |
| (a) Cleft 1—3·5 inches deep | ... 4. <i>purpurea</i> . |
| (b) Cleft 5—1·5 inches deep | ... 5. <i>variegata</i> . |

II.—A climber

- | |
|------------------------|
| ... 6. <i>VahlII</i> . |
|------------------------|

1. **Bauhinia racemosa**, *Lamk.*—A small deciduous tree with short bole and dense low spreading crown, the stem attaining 4·5 feet girth and 25 feet high. Bark dark grey or blackish, very rough, closely and rather deeply fissured, exfoliating in irregular hard woody scales. Blaze 6—8 inch, very fibrous throughout, bright pink. Leaves cleft 4—7 inch measured from the base of the cleft to the tangent to the two lobes, base cordate, 1·2–75 inches long (measured to the tip of the cordate lobes) by 1·5—4 inches broad, thinly coriaceous, glabrous above, glaucescent and more or less pubescent beneath, base with 5—9 prominent nerves. Petiole 4—1·1 inches long. Flowers white, 5—7·5 inch long, in terminal or leaf-opposed pubescent racemes 3—5 inches long. The spatheaceous green calyx and the white corolla-lobes ultimately reflexed. Pedicels 2—4 inch long. Pod 5—10 by 7—1 inch, turgid, rigid, falcate. Seeds 12—22, oblong, compressed, dark reddish-brown or black, 3 inch long.

Found in the Bhabar and subhimalayan tract between 1,000 and 2,000 feet. Not uncommon in dry open miscellaneous forests, especially those subjected to heavy grazing. Flowers: March—June. Fruit: January–February.

2. **Bauhinia malabarica**, *Roxb.* Vern. *Kachnār*, Gen. *Khatua*, R.—A medium-sized tree attaining 6 feet girth and 50 feet high, usually somewhat less. Bark dark brown or blackish, rough but not deeply fissured, exfoliating in thin scaly pieces and strips. Blaze 5—7·5 inch, very fibrous throughout, bright pink paling towards the interior and turning orange-brown on exposure. Leaves cleft 3—1 inch measured from the base of the cleft to the tangent to the two lobes, base cordate, 1·75—4 inches long (measured to the tip of the cordate lobes) by 2·25—5 inches broad, rather thickly coriaceous, glabrous above, glaucous and more or less pubescent beneath, base with 7—11 (usually 9) prominent nerves. Petiole 7—1·5 inches long. Flowers white, 5 inch long, in terminal paniculate racemes 1·5—3 inches long. Pedicels 5—1 inch long. Pod 7—12 by 7—1 inch, nearly straight, flat, flexible. Seeds 20—30, ovoid-globose, 2 inch long.

Occurs in the Bhabar and outermost ranges between 1,000 and 2,000 feet. Found both in *sal* and miscellaneous forests but seldom common. The leaves have a characteristic acid taste not possessed by the other *Bauhinias* of this area. Flowers: August—October. Fruit: January—May.

3. **Bauhinia retusa**, *Roxb.* Vern. *Kandlao*, G. *Kondla*, A.—A medium-sized deciduous tree attaining 8 feet girth and 50 feet high. Bark dark reddish-brown, rough, flaking off in thin woody strips and plates which remain for some time half-detached, sometimes with a few deep vertical fissures. Blaze 4—7 inch, soft, fibrous, bright or pale pink, the juice turning purple on the blade of a knife. Leaves entire or notched at the tip, 3—6 inches long, slightly broader than long, base

cordate or truncate, subcoriaceous, glabrous, base with 9—11 prominent nerves. Petiole 1·5—3·5 inches long. Flowers creamy-white mottled with purple, 6—1 inch across, in large lax terminal panicles, the lower branches of which are axillary. Pedicels 6—8 inch long. Pod 4—7 by 1·2—1·5 inches, oblong or oblanceolate, flat, firm, tinged with red until ripe. Seeds 6—8, flat, suborbicular, dark brown, smooth.

Occurs throughout the outer and central hill ranges occasionally descending into the Bhabar, at elevations between 1,000 and 4,000 feet. Abundant in the outer ranges where it is somewhat gregarious. Flowers: September—November. Fruit: April-May.

4. *Bauhinia purpurea*, Linn.—A small or medium-sized deciduous tree attaining 5 feet girth and 45 feet high. Bark slightly rough, dark brown or blackish, exfoliating in small hard woody scales. Bark of young stems and branches often somewhat corky. Blaze 5—11 inches, a narrower outer portion pinkish or purplish (absent on young stems), the broader inner portion pale orange or yellow slowly turning orange-brown on exposure, the tissue becoming very fibrous towards the interior. Leaves cleft 1·3—3·6 inches measured from the base of the cleft to the tangent to the two lobes, base usually cordate, 3—6 inches long (measured to the tip of the cordate lobes) by 2·8—5·5 inches broad, minutely pubescent beneath when young glaucescent when mature, base with 9—11 (usually 11) prominent nerves. Petiole 8—2 inches long. Flowers large, rosy-purple, in few-flowered terminal brown-tomentose panicles. Pedicels 2—5 inch long. Pod 6—10 by 6—8 inch, linear, flat, somewhat falcate, green often tinged with purple till ripe. Seeds 6—15, suborbicular, flattened, 5 inch diameter, smooth, dark brown.

Occurs in the subhimalayan tract and outermost ranges between 1,000 and 2,000 feet. Rather scarce. Flowers: September—November. Fruit: January—March.

5. *Bauhinia variegata*, Linn. Vern. *Kuirāl* or *Guirāl*, Gen. *Keorāb*, A.—A small or medium-sized deciduous tree attaining 5 feet girth and 50 feet high. Bark dark brown sometimes with silvery patches, rather rough, exfoliating in thin woody strips and scales. Blaze 3—6 inch, very fibrous throughout, bright pink or reddish, juice turning purple on the blade of a knife. Leaves cleft 4—1·3 inches measured from the base of the cleft to the tangent to the two lobes, base cordate, 2·5—5·5 inches long (measured to the tip of the cordate lobes) by 3—6 inches broad, pubescent beneath when young, subcoriaceous, base with 11—15 prominent nerves. Petiole 8—1·8 inches long. Flowers large, fragrant, appearing on leafless branches, in short axillary or terminal few-flowered racemes. Four petals white or purplish, the fifth darker with purple or red veins. Pod 6—12 by 7—1 inch, hard, flat, dehiscent. Seeds 10—15.

Occurs throughout the hills between 1,000 and 6,000 feet. Common in both miscellaneous and *chir* forests, especially on southern aspects and limestone soils. When flowering it is leafless or nearly so. Flowers: March-May.

6. **Bauhinia Vahlia**, W. and A. Vern. *Māldhan* or *Mālghan*, BD. *Mālu*, G. Mao, A.—An immense climber with wide-spreading stems up to 4 feet girth. Bark somewhat rough, dark reddish-brown or blackish. Blaze tough and fibrous, bright pink with white or yellowish bands slowly turning orange-brown on exposure. Branchlets often terminating in a pair of revolute tendrils. Young parts fulvous or rusty-tomentose. Leaves cleft 1—3·5 inches measured from the base of the cleft to the tangent to the two lobes, base deeply cordate, 4—18 inches long by about as broad, glabrescent above when mature, more or less densely tomentose beneath, base 11—15-nerved. Petiole 3—6 inches long, stout, tomentose. Flowers 1·5—2 inches across, white turning buff as they fade, in peduncled corymbose terminal densely tomentose racemes. Pedicels 1·2·5 inches long. Pod 9—12 by 2·3 inches, flat, woody, rusty-velvety. Seeds 6—12, suborbicular, 1 inch diameter, flat, dark brown, polished.

Abundant throughout the area in all kinds of forest up to 4,500 feet elevation but most abundant in miscellaneous forest. Often very destructive to tree growth. The bursting of the ripe pods produces a crack which may sometimes be heard a quarter of a mile away. Flowers: April—June. Fruit: April—May.

Sub-family III. Mimosoideæ.

Trees or shrubs, sometimes climbing, rarely herbs. Leaves bipinnate or less commonly simply pinnate. Flowers small, regular, usually 5-merous, usually hermaphrodite, sometimes polygamous, generally in heads or spikes. Calyx more or less campanulate with usually 5, sometimes 3, 4 or 6 valvate lobes, sometimes free. Petals as many as the sepals, valvate, free or connate in a lobed corolla. Stamens definite or indefinite; if definite as many as or twice as many as the sepals and petals, free or monadelphous. Ovary free. Pod dehiscent or not, sometimes jointed.

I.—Stamens definite.

- 1. Flowers in cylindric spikes. Pod not jointed ... 1. *Piptadenia*.
- 2. Flowers in globose heads. Pod with separating joints ... 2. *Mimosa*.

II.—Stamens indefinite.

- 1. Armed. Filaments free ... 3. *Acacia*.
- 2. Unarmed. Filaments united ... 4. *Albizzia*.

1. PIPTADENIA, *Benth.*

Erect trees, unarmed or prickly. Leaves bipinnate. Flowers small, in dense spikes, hermaphrodite, 5-merous. Calyx campanulate, shortly 5-toothed. Petals equal, lanceolate, cohering at the base. Stamens 10, free, as long as the corolla. Anthers tipped with a deciduous gland. Ovary stalked; ovules many; style filiform. Pod long, thin, strap-shaped.

***Piptadenia cudhensis*, Brand.**—A small tree with drooping branchlets; branches armed with large compressed conical prickles. Bark greyish or reddish-brown, rough, exfoliating in flat woody scales. Blaze fibrous, red. Leaves alternate, abruptly bipinnate; rachis 1—4 inches long bearing flat circular glands at the junction of the pinnæ. Pinnæ opposite, 1—3 pairs, 7—2·5 inches long, each bearing one pair of opposite leaflets, the pair resembling a *Bauhinia* leaf cleft to the base. Leaflets 2—3·5 by 1—3 inches, obliquely suborbicular or rhomboid, entire, subcoriaceous, glabrous, veins prominent on both surfaces anastomosing and forming loops within the margin. Petiolules 1 inch long. Flowers 1·5—2 inch long, greenish-yellow, in dense cylindric shortly pedunculate spikes 1—3 inches long, solitary or arranged on an

axillary rachis 1—4 inches long. Pod stalked, 8—12 by $\frac{1}{2}$ inch, flat, glabrous. Seeds 15—20, compressed, brown.

Occurs on the outermost hill ranges between 1,000 and 2,000 feet, but not recorded west of the Nandhaur Nadi. Flowers: April-May.

2. MIMOSA, *Linn.*

Herbs, shrubs or small trees, usually prickly. Leaves bipinnate; leaflets small, more or less sensitive, the rachis usually prickly; stipules and stipels small. Flowers polygamous, in globose pedunculate heads, the upper peduncles often forming a terminal raceme. Calyx campanulate, shortly 4-toothed. Petals 4, connate below. Stamens as many or twice as many as the petals, exserted. Ovary stipitate, many-ovuled. Pod flat, of several 1-seeded joints that separate when ripe from each other and from the persistent sutures.

A suberect or prostrate undershrub not exceeding 3 feet high. Pinnæ digitate 1. *pudica*.

An erect shrub up to 15 feet high. Pinnæ pinnately arranged 2. *himalayana*.

1. *Mimosa pudica*, *Linn.* Eng. The sensitive plant.—A small deciduous undershrub with prostrate or suberect weak spreading stems 6 inches to 3 feet high and scarcely exceeding $\frac{1}{2}$ inch diameter. Stems and branches prickly and densely clothed with deflexed bristles. Leaves very sensitive; rachis beset with ascending bristles; pinnæ usually 4, 2·5—3·5 inches long, sessile at the end of the petiole. Leaflets 12—20 pairs, 2—5 by $\frac{1}{10}$ — $\frac{1}{8}$ inch, obliquely narrow-oblong, acute, glabrous above, adpressed-bristly beneath. Flowers pink, in dense globose heads $\frac{1}{4}$ — $\frac{1}{2}$ inch diameter, the heads usually in pairs. Peduncles slender $\frac{1}{7}$ — $\frac{1}{8}$ inch long. Pod $\frac{1}{6}$ — $\frac{1}{8}$ inch long, flat, membranous, with very bristly sutures and 3—5 joints.

This plant is not indigenous, but is often found growing like a weed on waste land in the plains and at quite low elevations in the hills. Flowers: August-September. Fruit: November.

2. *Mimosa himalayana*, *Gamble.* Syn. *M. rubicaulis*, Lamk. Vern. *Khinkari*, SG and R.—A deciduous shrub with spreading or arching sparingly-branched stems up to 6 inches diameter and 15 feet high. Bark fairly smooth at first, ultimately rough, reddish-brown on young stems and branches, pale brown when mature. Stems up to about 2 inches diameter beset with numerous straight or recurved prickles up to $\frac{1}{15}$ inch long. Blaze 1—3 inch, very fibrous, bright pink to dark reddish-brown, juice turning purple on the blade of a knife. Leaf-rachis 4—9 inches long, usually very prickly. Pinnæ 5—12 pairs, 1·2·5 inches long. Leaflets 6—15 pairs, $\frac{1}{15}$ — $\frac{1}{4}$ by $\frac{1}{8}$ — $\frac{1}{15}$ inch, oblong, obtuse, glabrous above, paler and more or less pubescent beneath,

Petiolules minute. Flowers pink fading to white, in globose pedunculate heads .5-.6 inch diameter; peduncles 1-2 inches long, in axillary fascicles forming large terminal leafy panicles. Pods 3-4 by .4 inch, thin, flat, falcate, glabrous, with 4-10 joints.

Occurs throughout our area up to 5,000 feet. Common along open watercourses and in heavily grazed scrub forest. Flowers: July-September. Fruit: January.

3. ACACIA, Willd.

Trees or erect or climbing shrubs, usually armed. Leaves bipinnate, the pinnæ paripinnate; leaflets usually small; leaves sometimes transformed into phyllodes; stipules often transformed into spines; stipels 0. Flowers hermaphrodite or polygamous, usually 5-merous, in globose heads or cylindric spikes. Calyx campanulate. Petals more or less united, rarely free. Stamens indefinite, free or very shortly connate at the base. Ovary sessile or stalked, 2-many-ovuled. Pod variable, usually flat and dry, rarely turgid or coriaceous, usually dehiscent, never breaking into joints.

I.—Erect trees or shrubs.

A. Flowers in axillary globose heads. Spines straight.

- | | |
|--|------------------------------|
| 1. Pod contracted between the seeds, tomentose | 1. <i>arabica</i> . |
| 2. Pod not contracted between the seeds, glabrous. | |
| (a) Pod sub-cylindric, turgid | ... 2. <i>Farnesiana</i> |
| (b) Pod thin, ligulate | ... 3. <i>pseudæburnea</i> . |

B. Flowers in axillary spikes. Spines recurved.

- | | |
|--------------------------------|------------------------------|
| 1. Leaflets .15 inch long | ... 4. <i>Catechu</i> . |
| 2. Leaflets .7-1.2 inches long | ... 5. <i>lenticularis</i> . |

II.—Climbers.

- | | |
|--|-------------------------|
| 1. Leaflets 30-50 pairs, .15-.25 inch long | ... 6. <i>pennata</i> . |
| 2. Leaflets 10-30 pairs, .3-.4 inch long | ... 7. <i>torta</i> . |

The species which I have described as *A. torta*, Craib does not seem to agree exactly with published descriptions of either *A. torta*, Craib or *A. Gageana*, Craib, but appears to me to be nearer to *A. torta*. The ovary in our specimens is minutely pubescent. It has occurred to me that we have possibly a form intermediate between the two.

1. *Acacia arabica*, Willd. Vern. *Babūl*, Gen.—A medium-sized evergreen tree with rounded spreading crown. Bark dark brown or blackish with longitudinal fissures. Spines stipular, in pairs below the petioles, varying in size up to 2 inches long, sometimes wanting, yellowish-white. Rachis 1-3 inches long, often glandular. Pinnæ 3-10 pairs, .5-1.5 inches long. Leaflets 10-20 pairs, .1-.2 inch long, linear, glabrous or nearly so, subsessile. Flowers yellow, in globose pedunculate heads .5 inch diameter; peduncles .5-1 inch long, in axillary fascicles of 2-6. Pod 3-6 by .5-.6 inch, cylindric, contracted between the seeds, compressed, densely grey-tomentose, subindehiscent. Seeds 8-12,

This tree is not indigenous, but is completely naturalised in all the adjacent plains tracts and is commonly seen self-sown on railway embankments and roadsides. It is not known to what extent it occurs within our area, but its occurrence is probably restricted to the vicinity of roads and railways. Flowers: July—November. Fruit: May.

2. *Acacia Farnesiana*, Willd.—An evergreen thorny shrub or small tree. Bark fairly smooth, greenish or reddish-brown with numerous small pale lenticels. Blaze '3—'4 inch, pale yellow banded with pale pinkish-brown. Spines stipular, in pairs below the petioles, straight, whitish, '3—'7 inch long. Rachis '5—2 inches long. Pinnæ 2—8 pairs, '5—1 inch long. Leaflets 10—20 pairs, '05—'2 inch long, linear-oblong, acute, base oblique, nearly or quite glabrous, sessile. Flowers yellow, more or less fragrant, in globose pedunculate heads '4—'6 inch diameter. Peduncles '5—1 inch long, in axillary fascicles. Pod 2-3 by '5 inch, subcylindric, turgid, dark brown. Seeds numerous.

This plant is not truly indigenous, but has become completely naturalised and can be found growing apparently wild. It occurs practically throughout our area up to 5,500 feet, but is local and not very common. Flowers: January—April.

3. *Acacia pseudoburnea*, Drumm. mss. Vern. Babūr, Gen.—A small tree attaining 2'5 feet girth and 20 feet high. Bark dark grey or reddish-brown, rough with shallow cracks, exfoliating in small hard scales and strips. Blaze '3—'5 inch, pink or white with very fibrous bands of pink or reddish-brown. Spines in pairs below the petioles, '25—'8 inches long, straight, pale yellowish- or reddish-brown. Rachis '5—1'25 inches long, glandular-hairy. Pinnæ 1—6 pairs, '3—'5 inch long. Leaflets 6—12 pairs, '1—'15 inch long, coriaceous, glaucous. Flowers white, fragrant, in pedunculate globose heads '5—'7 inch diameter. Peduncles about 1 inch long, axillary, 1—3 together. Pod 2—4'5 by '2—'3 inch, thin, flat, straight, dehiscent, narrowly ligulate, coriaceous, glabrous and shining. Seeds 5—10.

Occurs in the subhimalayan tract and outer ranges of hills up to 4,000 feet. Sometimes fairly common, but locally distributed, usually in open miscellaneous forest on south aspects or in open stream-beds. Flowers: January-February. Fruit: April.

4. *Acacia Catechu*, Willd. Vern. Khair, Gen.—A medium-sized deciduous tree commonly attaining 7 feet girth and 50 feet high. Bark pale ashy to dark brown sometimes partly blackish, very rough, exfoliating in long woody rectangular strips which remain for long in a semi-detached condition. Blaze '5—'7 inch, rather shortly fibrous, pinkish outside, pale yellow inside. Prickles pseudo-stipular, in pairs below the petioles, strongly compressed with long bases, recurved, dark brown, about '2 inch long, often absent on old plants. Rachis 3—6 inches long, glandular, often prickly. Pinnæ 10—30 pairs, 1-1'5 inches long. Leaflets 30—50 pairs, about '15 inch long, linear; petiolules minute. Flowers pale creamy-white, in cylindric axillary pedunculate

spikes 2—4 inches long, usually solitary; peduncles .5—1 inch long. Pod 2—3.5 by .5—1 inch, thin, flat, straight, dehiscent. Seeds 3—6.

Occurs throughout the area up to 4,000 feet. Abundant in the Bhabar tract where it grows gregariously over large areas, especially on recent alluvial soils where it is often associated with *shisham*. Flowers: May—July. Fruit: January—March.

5. *Acacia lenticularis*, Ham. Vern. *Kain*, H.—A medium-sized tree up to 10 feet girth and 60 feet high. Bark grey, rough, exfoliating in irregular woody scales. Blaze .8—1.2 inches, bright reddish. Twigs reddish-brown, closely covered with minute pale lenticels. Branches armed with pairs of slightly recurved compressed stipular spines .15—1 inch long. Old trees nearly unarmed. Rachis 5—7 inches long, glabrous or slightly hairy with a gland below the pinnæ. Pinnæ 2—5 pairs, 2—5 inches long. Leaflets 6—12 pairs, oblong or obovate-oblong, subsessile, glabrous or nearly so, .7—1.2 by .3—1.5 inch, apex rounded or retuse. Flowers white, in dense pedunculate axillary spikes 3—5 inches long and about .5 inch diameter. Rachis glabrous. Pod flat, straight, 4—9 by 1—1.5 inches, glabrous. Seeds 4—8.

Occurs in grassy *choars* and open forests of the Bhabar tract east of Haldwani up to 2,000 feet but is scarce. Flowers: April-May.

6. *Acacia pennata*, Willd. Vern. *Agalai* or *Agla*, SG and R.—A large rambling climber rarely twining, the stem attaining 7 inches diameter and 80 feet high. Bark of stems up to about 4 inches diameter fairly smooth and pale brown with 5 distinct rows of short recurved prickles. Bark of older stems rough and blackish exfoliating in small woody scales. Blaze .3—1 inch, very fibrous, bright pink or red with narrow whitish bands (absent on very old stems), juice turning purple on the blade of a knife. Rachis 3—10 inches long, usually more or less prickly, glandular. Pinnæ 8—18 pairs, 1.5—4 inches long. Leaflets 30—50 pairs, .15—1.25 by .05 inch, linear, obtuse, oblique, glabrous. Flowers white, in globose pedunculate heads .3—1 inch diameter arranged in large terminal panicles, the lower branches of which are axillary; peduncles clustered 1—4 together, .4—1 inch long. Pod 4—8 by .6—1.2 inches, straight, flat, thin, glabrous, dark brown and shining when mature. Seeds 8—14.

Occurs throughout the area between 1,000 and 4,000 feet. Common in most types of forest at these altitudes, but especially in open areas of miscellaneous forest. Flowers: August-September.

7. *Acacia torta*, Craib.—A large rambling climber the stem attaining 6 inches diameter and 50 feet high, the branches more or less 5-angled, the angles becoming prominent ridges in stems over about 2 inches diameter. Recurved prickles up to .2 inch long are distributed along the crests of the five ridges. In old stems additional

ridges may form. Bark smooth, pale brown. Blaze 1—2 inch, very fibrous, pale orange. Rachis 5—10 inches long, 5-channelled, bearing recurved prickles on the undersurface, tomentose. Pinnæ 6—13 pairs, 1·5—5 inches long. Leaflets 10—30 pairs, 3·4 by 1—1·5 inch, upper surface dark glossy green, lower surface glaucous, both surfaces with adpressed hairs or the upper surface glabrous, linear-oblong, apex cuspidate, base truncate. Flowers white, in heads 4—6 inch diameter on peduncles 5·6 inch long. Calyx glabrous or glabrescent. Inflorescence a large terminal panicle the lower branches of which are axillary. Pod 4—6 by 8—1·1 inches, thin, flat, clothed with minute hairs and purplish when young, glabrous when mature. Seeds 5—11.

Occurs throughout the Bhabar and low valleys in the outer hills up to 3,500 feet. Fairly common in scrub and open miscellaneous forests where it is more often seen as a sarmentose shrub 6—12 feet high. Flowers: August-September. Fruit: April.

4. ALBIZZIA, *Durazz.*

Trees or shrubs without thorns or prickles, rarely climbing. Leaves evenly bipinnate; pinnæ paripinnate; stipules 0. Flowers in globose heads, rarely in spikes; peduncles distinct, axillary or in terminal panicles. Calyx campanulate or tubular, 5-lobed. Petals 5, connate in a funnel-shaped corolla. Stamens indefinite, monadelphous at the base, filaments long-exserted. Ovary sessile or shortly stalked, many-ovuled. Pod large, thin, flat, indehiscent or tardily dehiscent.

I.—Pinnæ 6—20 pairs 1. *stipulata*.

II.—Pinnæ 2—8 pairs.

A. Leaflets less than 5 inch broad.

1. Stamens 6—8 inch long, white ... 2. *odoratissima*.

2. Stamens 1·1·5 inches long, pink ... 3. *Julibrissin*.

B. Leaflets more than 5 inch broad.

1. Pinnæ 2-3 pairs. Stamens 1·1·75 inches long 4. *Lebbek*.

2. Pinnæ 2—6 pairs. Stamens 4·5 inch long 5. *procera*.

1. *Albizzia stipulata*, *Boiv.* Vern. *Siris*, Gen. *Kālu-siri*

A medium-sized deciduous tree with open spreading crown attaining 6 feet girth and 80 feet high. Bark grey, smooth, with horizontal wrinkles and occasional deep wide vertical fissures and with scattered small lenticels. Blaze 5—1 inch, cheesy, not fibrous, deep claret-coloured with bands of pink and streaks of white, gradually becoming whitish and somewhat fibrous next the wood, juice turning purplish on the blade of a knife. Rachis 6—12 inches long, glandular. Stipules large, caducous. Pinnæ 6—20 pairs, 2—6 inches long. Leaflets 20—45 pairs, 3—5 by about 1 inch, linear-oblong, acute, slightly falcate, glabrous above, downy beneath, midrib very close to the upper edge. Flowers in

panicked heads arranged in axillary and terminal panicles. Peduncles 7—12 inches long. Corolla 2—25 inch long, yellowish-white. Stamens 1—13 inches long, white tinged with pink. Pod 4—7 by 5—7 inch, thin, glabrous, light brown. Seeds 8—10.

Occurs throughout the area between 1,000 and 4,500 feet. Seldom common and generally seen in open types of forest, especially grassy blanks in *sal* areas. It has been measured up to 13 feet girth. Flowers: April—June. Fruit: December—March.

2. *Albizzia odoratissima*, Benth.—A small subdeciduous tree attaining 4.5 feet girth and 60 feet high. Bark dark brown, slightly rough and thinly corky outside, exfoliating in irregular woody scales. Blaze 4—7 inch, very shortly fibrous, pink or red often with paler streaks, juice turning purple on the blade of a knife. Rachis 4—8 inches long, glandular. Pinnæ 3—8 pairs, 3—6 inches long. Leaflets 8—20 pairs, 7—1 by 2—4 inch, oblong, usually obtuse, midrib about one-third the breadth of the leaflet from the upper edge, pubescent or nearly glabrous above, tomentose or pubescent beneath, subsessile. Flowers fragrant, in peduncled heads, which are solitary or in fascicles of 2—4 arranged in a large terminal panicle, the lower branches axillary. Peduncles 5—13 inches long. Corolla 3 inch long, pale yellowish-green. Stamens 6—8 inch long, white. Pod 3.5—8 by 6—12 inches, thin, flat, reddish-brown, ultimately glabrous or pubescent. Seeds 4—12.

Occurs throughout the area up to 3,500 feet. Scarce within the hills, but fairly common along the outermost range and in the Bhabar. Flowers: May—June. Fruit: March—April.

3. *Albizzia Julibrissin*, Durazz. Syn. *A. mollis*, Boiv. Vern. *Kaunēra*, Gen. *Bhandār*, SG. *Sirsa*, NG.—A medium-sized deciduous tree attaining 6 feet girth and 50 feet high. Bark rough, dark brown or blackish, exfoliating in small irregular woody scales. Blaze 3—5 inch, soft, shortly fibrous, bright pink, reddish-brown or claret-coloured. Rachis 4—10 inches long, glandular. Pinnæ 4—7 pairs, 3—6 inches long. Leaflets 10—30 pairs, 5—7 by 15—25 inch, oblong, falcate, acute, oblique, more or less adpressed-hairy on both surfaces, midrib close to the upper edge, subsessile. Flowers fragrant in peduncled heads, which are solitary or in fascicles of 2-3 arranged in a short terminal raceme, the lowest often axillary. Peduncles 1.5—3 inches long. Corolla 3—5 inch long, greenish-yellow. Stamens 1-1.5 inches long, basal half white fading to pale orange-yellow, upper half rosy-pink or pale purple. Pod 3—7 by 6—1 inch, thin, ultimately glabrous, pale brown or yellowish. Seeds 5—12.

Occurs throughout the hills from 5,000 to 8,000 feet. Fairly common in *banj* oak forest and along the banks of streams in *chir* forest. Flowers: April—June. Fruit: November—December.

4. *Albizzia Lebbeck*, Benth. Vern. *Siris*, Gen. *Bhandir*, Gen.—

A large deciduous tree with spreading crown, attaining 13 feet girth and 85 feet high. Bark dark brown or blackish often with silvery patches on the branches, rough, exfoliating in irregular thick woody scales. Blaze .5—1 inch, outer half of rich deep reddish rather hard not fibrous tissue, inner half of pale yellowish fibrous tissue, juice turning purple on the blade of a knife. Rachis 3—6 inches long, usually glandular. Pinnæ 2-3 pairs, 2—8 inches long, often glandular. Leaflets 3—9 pairs, 1-2 by .6—1 inch, the lateral oblong, the terminal obovate, glabrous or pubescent; petiolules very short. Flowers very fragrant, in pedunculate heads. Peduncles 2—4 inches long, solitary or in fascicles of 2—4, axillary. Corolla .3—4 inch long. Stamens 1-1.75 inches long, white fading yellowish the terminal third green. Pod 6—12 by 1-2 inches, thin, flat, strap-shaped, rigid, yellow. Seeds 8—13, pale brown, compressed, about .3 inch diameter.

Occurs throughout the area up to 3,500 feet. Fairly common in miscellaneous forests of the Bhabar tract, especially in valleys and on the banks of streams. Flowers: April-May. Fruit: January—March.

5. *Albizzia procera*, Benth. Vern. *Karāo*, SG. *Karha*, R.—

A large deciduous tree attaining 10 feet girth and 110 feet high. Bark smooth or nearly so, exfoliating in thin woody plates leaving shallow scars, pale greenish-yellow becoming pale yellowish-brown on mature stems. Blaze .5—7 inch, fibrous, bright pink or reddish usually mottled and narrowly banded with white, juice turning purple on the blade of a knife. Rachis 12—18 inches long, glandular. Pinnæ 2—6 pairs, 5—9 inches long. Leaflets 6—16 pairs, 1-2 by .6—9 inch, ovate-oblong, oblique, obtuse, minutely adpressed-pubescent on both surfaces or glabrescent, the midrib nearer the lower edge; petiolules .05 inch long. Flowers in peduncled heads arranged in large lax terminal panicles. Peduncles usually in fascicles of 2—5, sometimes solitary, .5—1 inch long. Corolla .2 inch long, yellowish-white. Stamens .4—5 inch long, pale yellow. Pod 4—8 by .7—1 inch, glabrous, brown, thin, flexible. Seeds 6—12.

Occurs in the subhimalayan tract and outer and central ranges up to 3,000 feet. Common in miscellaneous forest bordering rivers and streams. Flowers: June—August.

XXXIV.—ROSACEÆ.

Herbs, shrubs or trees. Leaves alternate, rarely opposite, simple or compound; stipules free or adnate to the petiole, rarely 0. Flowers usually regular and hermaphrodite. Calyx-tube free or adnate to the ovary, usually 5-lobed, often bracteolate. Disk lining the calyx-tube or forming a ring at its base. Petals 5, rarely 0, inserted under the margin of the disk. Stamens perigynous, usually indefinite, in one or more series. Ovary of 1 or more free or connate carpels; ovules 1 or more in each carpel; styles free or connate. Fruit variable, of achenes berries or drupes, rarely capsular.

I.—Ripe carpels not enclosed within the calyx-tube.

A.—Carpels, solitary.

- 1. Style in fruit terminal. Petals large ... 1. *Prunus*.
- 2. Style in fruit terminal. Petals minute ... 2. *Pygeum*.
- 3. Style in fruit subbasal. Petals large ... 3. *Prinsepia*.

B. Carpels, 5 or more.

- 1. Prickly shrubs. Fruit succulent ... 4. *Rubus*.
- 2. Unarmed shrubs. Fruit dry. *
- (a) Calyx ebracteolate. Fruit dehiscent ... 5. *Spiræa*.
- (b) Calyx bracteolate. Fruit indehiscent ... 6. *Potentilla*.

II.—Ripe carpels enclosed within the calyx-tube.

A. Carpels many, free. Prickly shrubs with compound leaves ... 7. *Rosa*

B. Carpels 1—5, connate or adnate to the calyx-tube. Leaves simple, or when compound plant unarmed.

- 1. Fruit pomaceous. Ovary 5-celled.
 - (a) Endocarp membranous or cartilaginous ... 8. *Pyrus*.
 - (b) Endocarp crustaceous, dehiscing longitudinally ... 9. *Stranvæsia*.
- 2. Fruit drupaceous. Ovary 2—5-celled.
 - (a) Leaves cut, toothed, or serrate ... 10. *Cratægus*.
 - (b) Leaves entire ... 11. *Cotoneaster*.

1. PRUNUS, Linn.

Trees or shrubs, mostly unarmed and deciduous. Leaves simple, entire or toothed; petiole often 2-glandular. Flowers white or pink, solitary, fascicled, corymbose or racemose. Calyx-tube various, partially or completely deciduous in fruit, lobes 5. Petals 5, conspicuous. Stamens usually 20. Carpel 1; style terminal; ovules 2. Fruit a drupe

with an indehiscent or two-valved smooth or rugged stone, 1- rarely 2-seeded.

I.—Flowers pink, solitary or fascicled.

- | | | |
|--|-----|--------------------------|
| A. A small shrub, leaves about 1 inch long | ... | 1. <i>Jacquemontii</i> . |
| B. Trees with leaves exceeding 2 inches long | | |
| 1. Pedicels slender .3—·6 inch long | ... | 2. <i>cerasoides</i> . |
| 2. Pedicels 0 or quite short | ... | 3. <i>Persica</i> . |

II.—Flowers white, in racemes.

- | | | |
|--|-----|------------------------|
| A. Leaf-base cordate. Petiole glandular, .7 inch long or more | ... | 4. <i>cornuta</i> . |
| B. Leaf-base not cordate. Petiole eglandular, less than .7 inch long | | |
| 1. Secondary nerves 5—7 pairs | ... | 5. <i>acuminata</i> . |
| 2. Secondary nerves 8—12 pairs | ... | 6. <i>undulata</i> . |
| 3. Secondary nerves 16—25 pairs | ... | 7. <i>nepalensis</i> . |

1. ***Prunus Jacquemontii***, Hook f. Vern. *Kursang* or *Targui*, Bhotia.—A small deciduous shrub usually forming a low dense bush 1-2 feet high, but stems up to 6 feet high and 1·5 inches diameter. Bark smooth with distant pale transverse lenticels, dark grey or blackish, peeling off in thin lateral rolls. Leaves 1 inch long, elliptic obovate or narrowly oblong, serrate, glabrous, narrowed into a puberulous petiole .1-·2 inch long. Flowers pink, appearing before or with the leaves, 1-3 together, on puberulous pedicels .1 inch long. Petals obovate, .2 inch long. Drupe .3 inch long, ovoid, nearly dry, stone smooth.

Occurs in Garhwal up the Niti valley between 9,500 and 11,500 feet. Here it is fairly common on open stony south aspects, and is much browsed down by sheep. Flowers: May. Fruit: July-August.

2. ***Prunus cerasoides***, D. Don. Syn. *P. Puddum*, Roxb. Vern. *Payan*, Gen.—A medium-sized deciduous tree. Bark smooth, peeling off in thin horizontal strips. Twigs pendulous. Leaves 2-3 inches long, elliptic or ovate-lanceolate, acuminate, finely simple or double serrate, glabrous and shining above. Petiole .5 inch long with 2-4 glands near the top. Flowers pink, 1·3-1·7 inches diameter, appearing before or with the leaves in umbellate fascicles. Pedicels slender, .3-·6 inch long. Fruit an ovoid drupe, .5-·7 inch long, red or yellow; stone rugose and furrowed.

Occurs throughout the hills between 2,000 and 7,000 feet. Fairly common on the outer hill ranges. Flowers: October-December. Fruit: April-May.

3. ***Prunus Persica***, Stokes. Vern. *Khirōla*, NG. *Aru*, Gen. Eng. The Peach.—A small deciduous tree. Bark rough, dark grey, exfoliating in small strips a few inches long. Blaze orange-brown paling towards the interior. Leaves simple, 2·5-4 inches long, lanceolate ovate-lanceolate or lanceolate-oblong, acuminate, usually hairy on the midrib beneath when young, serrate. Petiole .2-·7 inch long,

glandular or not. Stipules fimbriate. Flowers 1-1.5 inches across, pink, usually before sometimes with the leaves, sessile or shortly pedicelled, mostly solitary on the previous year's wood. Drupe downy, succulent, stone deeply furrowed.

The Peach though not indigenous is cultivated throughout the area, but mainly in the hills. In the Dhauri valley in Upper Garhwal this species has become completely naturalised and is found growing practically wild between 8,000 and 10,500 feet. Flowers: January—May. Fruit: May—October.

4. *Prunus cornuta*, Wall. Syn. *P. Padus* of F. B. 1. non Linn. Vern. *Jāmun* or *Jāmuna*, Gen. Eng. The Bird-Cherry.—A small or medium-sized deciduous tree attaining 6 feet girth and 60 feet high. Boughs rather short, spreading horizontally. Bark roughish, exfoliating in small irregular woody scales, light grey or brown becoming blackish on old stems. Blaze .4—·75 inch, pinkish-brown, fibrous, and with peculiar cellular structure due to narrow fibrous bands running in two directions at right angles. Leaves 4—6.5 by 1.5—2.5 inches, oblong-lanceolate or oblong-ovate, acuminate, base cordate or rounded, closely serrate, glaucous beneath, main lateral nerves 12—16 pairs bearded in the axils beneath. Petiole .7—1.7 inches long, pink or red, usually with a pair of glands near the top. Bud-scales and floral bracts large, pink. Flowers .2-.3 inch diameter, white, in terminal or axillary drooping racemes 4—6 inches long. Fruit a globose drupe .3—·5 inch long, first red, then black when fully ripe; stone thick, rugose.

Occurs throughout the hills between 6,500 and 11,000 feet. Sometimes only a shrub. Very common in many forests of *karshu*, *telunj* or silver fir on the inner ranges, especially in moist localities. The bruised leaves and bark smell of almonds. The leaves turn bright orange or yellow before falling. Leaf-fall often commences in July. Flowers: April-May. Fruit: July—October.

5. *Prunus acuminata*, Wall.—A small evergreen tree up to 5 feet girth. Twigs slender, glabrous. Leaves 3—5 by 1-1.7 inches, lanceolate or oblong-lanceolate, caudate-acuminate, sharply serrulate or entire, base obtuse or rounded, glabrous, without tufts of hair in the nerve-axils beneath, main lateral nerves 5—7 pairs. Petiole .2—·6 inch long, glabrous, without glands. Flowers .25—·35 inch diameter, yellowish-white, in solitary or fascicled slender axillary racemes 1.5—4 inches long. Pedicels .15—·2 inch long (in the specimen collected by Mr. W. J. Lambert in East Almora on which the occurrence of this species within our area is based, the pedicels attain .6 inch long). Rachis and pedicels glabrous. Drupe ovoid, about .4-.5 inch long. Stone thin, smooth.

This species has been recently collected in East Almora and is reported to occur in the Sarju, Gori and Kali valleys between 2,000 and 2,500 feet. Flowers: September-October.

6. *Prunus undulata*, Ham. Vern. *Aria* or *Gadh-arū*, NG. *Aruca*, A.—A medium-sized deciduous tree with rounded crown attaining 6 feet girth and 50 feet high. Bark rough, dark grey or blackish, often with conspicuous raised circular lenticels and exfoliating in small woody scales. Blaze .4-.5 inch, strongly reticulate-fibrous, pale yellowish- or pinkish-brown rapidly turning reddish-brown on exposure. Leaves 3-4.5 by 1-1.75 inches, oblong or elliptic, usually widening upwards, acuminate, base rounded, closely and shallowly apiculate-crenate, glabrous except for tufts of hairs in the lower nerve-axils beneath, secondary nerves 8-12 pairs. Petiole .3-.5 inch long, usually, if not always, without glands. Flowers .3-.4 inch diameter, white, in solitary erect racemes 2-5 inches long on the old wood in the axils of leaf-scars. Pedicels .1-1.5 inch long. Rachis and pedicels pubescent. Drupe ovoid, .2 inch long, seated on the persistent calyx, red becoming black when ripe.

Occurs throughout the central and inner ranges between 4,500 and 9,000 feet. Not uncommon in moist localities and along the banks of streams. Flowers: April-May. Fruit: July.

7. *Prunus nepalensis*, Ser. Vern. *Bhang-bhālu*, Bhotia.—A small deciduous tree. Bark fairly smooth, grey, with large circular lenticels. Blaze .3-.4 inch, orange-brown. Leaves 4-8 by 1-2.5 inches, lanceolate or oblong-lanceolate, finely crenate-serrate, acuminate, base usually acute not cordate, glabrous, glaucous and without tufts of hair in the nerve-axils beneath, secondary nerves 16-25 pairs. Petiole .3-.5 inch long, without glands. Flowers about .3 inch diameter, white, in terminal racemes 3-5 inches long. Pedicels .15-.25 inch long. Rachis and pedicels pubescent. Drupe ovoid, .5-.75 inch long, red becoming purplish-black when ripe, fleshy. Stone thick, smooth.

Occurs on the central and inner ranges between 5,500 and 6,500 feet, but is scarce. Flowers: April-May. Fruit: October-November.

2. PYGEUM, Gærtn.

Evergreen shrubs or trees. Leaves simple, alternate, sometimes with a pair of flat circular glands at the base of the blade; stipules minute, caducous. Flowers small, in racemes, sometimes male only by suppression of the ovary. Calyx-tube deciduous usually in a ring at the middle; lobes 5-6, very small. Petals 5-6, like the sepals or very small and villous. Stamens 10-40, often in series of 10. Carpel 1; ovules 2. Fruit a transversely ellipsoid, obscurely 2-lobed, indehiscent drupe; pericarp thin, dry or fleshy.

***Pygeum acuminatum*, Colebr.**—A small evergreen tree. Twigs at first densely tomentose, soon becoming quite glabrous. Leaves 4-6.5

by 1.75—2.75 inches, elliptic or ovate-oblong, entire, acute or shortly acuminate, base rounded or shortly acute, densely tomentose on the undersurface when young but soon becoming glabrous, shining, coriaceous, midrib and 6—8 pairs of secondary nerves prominent beneath. Petiole .4—.7 inch long, grooved above. Flowers yellowish-green, in axillary tomentose racemes 2—5 inches long. Pedicels about .1 inch long. Calyx tomentose. Drupe transversely-oblong, .6—.7 inch on the longer diameter, with a shallow median furrow, somewhat woody.

This species has been recently collected by Mr. H. G. Champion in the Bhargot Nalla of the Haldwani Division, which is a westerly extension of its previously known distribution. Flowers: August. Fruit: April—June.

3. PRINSEPIA, Royle.

A shrub. Leaves lanceolate, serrate. Calyx persistent, tube cup-shaped with 5 unequal rounded lobes. Petals 5, inserted at the mouth of the calyx, rounded, short-clawed. Stamens many, inserted with the petals; filaments short. Carpel solitary, sessile; ovules 2. Fruit a fleshy drupe.

Prinsepia utilis, Royle. Vern. *Bhēkal*, Gen.—A bushy sub-deciduous shrub usually 4—6 feet high, but attaining 12 feet with stem 3 inches diameter. Young branches smooth and green, armed with straight stout axillary thorns up to 1.5 inches long. Bark rough, pinkish or grey, exfoliating in thin almost papery scales. Blaze .1 inch, yellowish. Leaves 1—3 inches long, lanceolate, narrowed at both ends, minutely serrate, coriaceous, glabrous. Petiole .2—.3 inch long. Flowers .4—.5 inch diameter, white, in short axillary racemes; pedicels .2—.5 inch long. Drupe oblong-cylindric, fleshy, .5—.7 inch long, purple when ripe. Seed one, smooth.

Occurs throughout the hills between 3,000 and 9,500 feet. Common in secondary scrub forest near cultivation, especially on open sunny aspects. Flowers: December—April. Fruit: May—July.

4. RUBUS, Linn. (*The Raspberries and Blackberries.*)

Creeping herbs or erect or climbing shrubs, usually prickly. Leaves alternate, simple or compound; stipules free or adnate to the petiole. Flowers in panicles, rarely solitary, white or red. Calyx-tube broad; lobes 5, persistent. Disk lining the calyx-tube. Petals 5. Stamens many, inserted on the margin of the calyx-tube. Carpels many, on a convex receptacle; ovules 2. Fruit a cluster of small fleshy 1-seeded drupes crowded on the receptacle, rarely few.

I.—Leaves 1-foliate.

A. Leaves more or less densely pale tomentose beneath.

- | | |
|--|-------------------------|
| 1. Leaves acuminate, obscurely lobed or not ... | 1. <i>paniculatus</i> . |
| 2. Leaves orbicular, always more or less lobed ... | 2. <i>reticulatus</i> . |

- B.—Leaves glabrous beneath ... 3. *acuminatus*
- II.—Leaves digitately 3—5-foliate.
1. Terminal leaflet elliptic or oblanceolate ... 4. *alpestris*.
2. Terminal leaflet sessile, rhomboid-ovate ... 5. *almorensis*.
- III.—Leaves pinnate. Leaflets usually 3.
- A. Flowers pink ... 6. *niveus*.
- B. Flowers white.
1. Stems covered with white waxy bloom ... 7. *biflorus*.
2. Stems not covered with a white bloom
- (a) Stems tomentose, bristly.
- (i) Lower leaf-surface with dense short tomentum, canescent ... 8. *ellipticus*.
- (ii) Lower leaf-surface glabrous except the nerves, green ... 9. *fasciculatus*.
- (b) Stems glabrous, no bristles ... 10. *macilentus*.
- IV.—Leaves pinnate. Leaflets usually 5—7.
- A. Flowers pink ... 11. *lasiocarpus*.
- B. Flowers white ... 12. *rosæfolius*.

In addition to these, *Rubus nutans*, Wall. occurs throughout the central and inner ranges between 6,500 and 10,000 feet. The creeping slender unarmed stems are perennial, but scarcely woody. It has trifoliate leaves, large white flowers the calyces of which are densely clothed with long pink bristles, and an edible red fruit.

1. *Rubus paniculatus*, Smith. Vern. *Kathula*, NG.—An ever-green climber with rambling branches and stems which attain 3 inches diameter and 40 feet high. Twigs densely white-tomentose, sparsely armed with short recurved prickles up to .1 inch long. Old stems often develop swellings at the joints. Bark roughish, pale ashy or pale brown, exfoliating in small thin irregular scales. Blaze .2-.3 inch, fibrous, pinkish-brown closely and finely streaked with reddish-brown, the whole turning orange-brown on exposure. Leaves simple, 3.5—8 by 3—6 inches, ovate-cordate, long or shortly acuminate, obscurely 3—5-lobed or not, base 3—5-nerved with 3—6 secondary pairs above the basal, toothed, upper surface clothed when young with deciduous tomentum, lower surface velvety with short dense white tomentum. Petiole .5—2.5 inches long, terete, white-tomentose, usually with a few prickles. Flowers white, .7-.8 inch across the green sepals, in loose terminal panicles, lower branches sometimes in the axils of the upper leaves. Pedicels .2—1 inch long. Fruit .5 inch diameter, black. Drupelets succulent, glabrous.

Occurs throughout the hills between 4,000 and 7,000 feet. Common, especially bordering streams and in moist depressions in *bamj* forest. Flowers: May-June. Fruit: June-July.

2. *Rubus reticulatus*, Wall.—A straggling shrub. Twigs clothed with short pale tomentum and sparsely armed with short recurved prickles. Leaves simple, 3.5—7.5 by 3—7 inches, cordate-orbicular,

more or less 5—7-lobed, finely toothed, sparsely hairy above, densely white-tomentose beneath, base 5-nerved, with conspicuous reticulate venation throughout. Petiole 1·5—3·5 inches long, tomentose, usually with a few prickles. Flowers white, about ½ inch diameter, in few-flowered corymbs which are either axillary or arranged in a terminal panicle. Pedicels 3—5 inch long, tomentose. Fruit black.

This species is reported to occur in the Central and East Almora Divisions between 7,000 and 8,000 feet. There is only one incomplete specimen at Dehra Dun collected from the Pindari valley by Mr. F. B. Dickinson. Flowers during the rains.

3. *Rubus acuminatus*, Sm.—A shrub with long arching branches. Twigs glabrous, sparsely armed with short recurved prickles. Leaves simple, 2·5—4·5 by 1-2 inches, ovate or ovate-oblong, caudate-acuminate, base cuneate or truncate, finely 1- or 2-serrate, base 3-nerved with 5—7 pairs of secondary nerves above the basal, glabrous beneath, more or less hairy on the main nerves above. Petiole 4—8 inch long, glabrous or nearly so, usually with a few prickles. Flowers white, 4·5 inch diameter, in few-flowered corymbs which are either axillary or arranged in a terminal panicle up to 12 inches long. Pedicels glabrous, 3—6 inch long. Fruit scarlet, enclosed by the calyx.

This species is reported to occur in the Ranikhet and East Almora Divisions between 3,000 and 7,000 feet. There is only one specimen from this area at Dehra Dun, and this is believed to have been collected by Duthie in the Sarju valley. Flowers: August-September.

4. *Rubus alpestris*, Blume.—A deciduous shrub with rambling, sometimes almost scandent stems up to 10 feet long and 75 inch diameter, armed with nearly straight distant prickles up to ¼ inch long. Twigs smooth, usually tinged purple, glabrous or with scattered gland-tipped bristles when quite young. Leaves digitately 3- and exceptionally 5-foliate, the lateral leaflets somewhat smaller and oblique. Terminal leaflet 2·5—4·5 by 1-1·7 inches, elliptic or oblanceolate, acuminate, base cuneate, acutely 1- or 2-crenate-serrate, sparsely pubescent on both surfaces especially on the nerves beneath, secondary nerves 7—10 pairs armed with a few small prickles beneath. Petiole 7—1·7 inches long, clothed with spreading hairs and gland-tipped bristles. Stipules linear-lanceolate, 3-4 inch long. Flowers white tinged with green, 8—1 inch diameter, 1—3 together, axillary or terminating the short lateral branches. Calyx armed with short straight prickles, densely tomentose on the lobes outside and with pink gland-tipped bristles, lobes caudate. Pedicels 4—8 inch long. Fruit 5 inch diameter, bright red. Drupelets succulent, glabrous.

Occurs throughout the main Himalayan range between 7,500 and 9,500 feet. It is found in forest of *Quercus semecarpifolia*, but is not common. Flowers: June-July. Fruit: July—September.

5. **Rubus almorensis**, *Dunn*.—An undershrub with prostrate weak straggling stems, sparsely armed with short recurved prickles. Twigs densely clothed with short grey tomentum. Leaves digitately 3-foliolate or sometimes 3-lobed towards the end of the branches and on vigorous young shoots. Petiole 1·5—2·5 inches long, densely tomentose, usually armed with a few short prickles. Stipules 4—7 inch long, free, ovate, deeply pectinate. Leaflets sessile, more or less lobed, acutely serrulate, rugose above with prominent reticulate venation beneath, lower surface tomentose but not white, upper surface sparsely hairy. Terminal leaflet, 2-3 by 1·5—2·5 inches, rhomboid-ovate, usually acute, base cuneate. Lateral leaflets oblique, base rounded. Flowers white, about 8 inch diameter, in small terminal panicles. Pedicels 5—1 inch long, with a pair of large pectinate bracts at the base. Calyx densely tomentose, teeth lanceolate-acuminate. Fruit red, succulent. Drupelets large, few.

This species was collected by Mr. W. J. Lambert in the Ramganga valley below Nimakpani at about 8,500 feet. He thinks it may be a hybrid between *R. nutans*, Wall and *R. reticulatus*, Hook f. Flowers towards the end of the rains.

6. **Rubus niveus**, *Wall*.—A deciduous shrub with erect or sub-erect usually arching stems 2—6 feet high and up to 5 inch diameter. Stems without waxy bloom, yellowish-brown or reddish. Twigs glabrous or tomentose. Prickles few or many, hooked or nearly straight, extending to the petioles and sometimes to the inflorescence. Leaves on canes of the year up to 12 inches long. Leaves on old canes 3—6 inches long; leaflets 3, rarely 5; lateral leaflets 1-2·5 inches long, sessile or with petiolules up to 4 inch long, usually ovate; terminal leaflet often cordate and lobed; all sharply 1- or 2-serrate, usually hairy above, green and glabrescent (*R. concolor*, Wall.) or more usually white-tomentose beneath, nerves prominent on the lower surface. Petiole glabrous or tomentose. Flowers pink, 3—1 inch across, the lower axillary, often solitary, the upper often forming a terminal raceme. Pedicels 1-1 inch long, tomentose. Calyx densely tomentose; lobes ovate-lanceolate, acuminate. Petals shorter than the calyx, erect. Fruit dull red, 5 inch diameter. Drupelets numerous, hairy.

Occurs throughout the hills between 5,500 and 11,500 feet. Very common and often gregarious in openings in forest of *Quercus semecarpifolia* or *Betula utilis*. Flowers: April—June. Fruit: June-July. An exceedingly variable plant with many varieties. A variety (my specimens numbered 689, 698 and 749 at Dehra Dun) found between 7,000 and 8,500 feet in the Dhauli valley of North Garhwal had low almost procumbent stems, leaves densely white-tomentose beneath, the terminal leaflet suborbicular, and the petals white or faintly tinged pink. The fruit was orange-red when ripe. This is probably var. *racemosus*.

7. **Rubus biflorus**, *Buch.-Ham.*—A suberect deciduous shrub with arching stems up to 8 feet high and 2 inches diameter, armed with

nearly straight prickles up to .5 inch long. Bark smooth, mahogany-red, or purplish-brown, covered with a white waxy bloom. Leaves on canes of the year up to 12 inches long. Leaves on old canes 2—6 inches long; leaflets usually 3, but sometimes 5 and rarely 1 or 7; lateral leaflets 1.2—1.5 inches long, sessile, ovate; terminal leaflet 1.5—3 by .7—1.5 inches, usually broader than the lateral, often cordate and 3-lobed; all nearly glabrous above, white-tomentose beneath, incisoserrate. Petiole and rachis glabrous or tomentose, armed with stout recurved prickles. Flowers white .7—1 inch diameter, axillary, solitary or in few-flowered umbelliform cymes. Pedicels slender, usually glabrous, sometimes prickly, .5—1.5 inches long. Calyx glabrous or tomentose without, lobes broadly ovate, short-acuminate. Fruit orange or yellow, .6—1 inch diameter. Drupelets many, glabrous, succulent.

Occurs throughout the hills between 6,500 and 9,500 feet. Fairly common, but somewhat local with a tendency to gregariousness in newly formed openings in oak forest such as where fellings have occurred. Flowers: April—June. Fruit June-July.

8. *Rubus ellipticus*, Smith. Vern. *Hinsālu*, BD. *Hisra*, G. *Hissāb*, A.—An evergreen shrub with suberect often arched or straggling stems up to 8 feet high and 1.5 inches diameter. Twigs tomentose, glands scanty, bristles numerous rusty-brown. Prickles short, stout, conical, slightly curved on the branches hooked on the petioles and midrib. Leaves trifoliate, 4—8 inches long. Petiole stout, tomentose, bristly, 1—3 inches long. Terminal leaflet 2.5—4 by 1.75—3.25 inches, elliptic or orbicular-obovate, retuse or abruptly acute, hairy above, pale with dense short tomentum beneath, closely and finely toothed, with 9—12 pairs of secondary nerves prominent beneath and considerably depressed above. Lateral leaflets smaller. Flowers white, .3—1 inch diameter, in dense axillary and terminal panicles. Pedicels .2—1 inch long, tomentose. Calyx tomentose. Fruit yellow, .5 inch diameter. Drupelets succulent, glabrous.

Abundant throughout the hills between 2,500 and 7,000 feet. Found in all types of forest, but is typical of open *chir* and *banj* forest. Flowers: January—April. Fruit: April-May.

9. *Rubus fasciculatus*, Duthie.—An evergreen shrub with suberect often arched or straggling stems up to 8 feet high and 1.5 inches diameter. Twigs pubescent, bristles numerous pink. Prickles short, stout, straight on the branches, hooked on the petioles and midrib. Leaves trifoliate, the lateral smaller. Petiole stout, tomentose, bristly, .5—1.8 inches long. Terminal leaflet 2—5 by 1.5—3.5 inches, elliptic or orbicular, abruptly short-acuminate, glabrous above, glabrous beneath except for a few scattered hairs on the nerves, closely and finely toothed, with 8—10 pairs of secondary nerves, prominent beneath. Flowers

white, .5-.6 inch diameter, in dense axillary fascicles and short terminal panicles. Pedicels .2-.4 inch long, tomentose. Calyx tomentose. Fruit yellow. Drupelets rather dry, glabrous.

Occurs throughout the hills between 5,500 and 8,000 feet. Fairly common along ravines and watercourses in shady forest, but somewhat local. Flowers: March-April. Fruit: May-June.

10. *Rubus macilentus*, Camb. Vern. *Insula*, NG.—A suberect evergreen shrub with low rambling stems not rising more than 1-2 feet from the ground. Twigs glabrous, shining. Prickles much flattened from a broad base, curved or nearly straight, extending to the leaves. Leaves on canes of the year up to 8 inches long. Leaves on old canes up to 5 inches long; leaflets 3, rarely 1, the terminal usually twice the size of the lateral; lateral .5-2 inches long, subsessile, ovate or ovate-lanceolate; terminal 1-3 by .6-1.5 inches, lanceolate or sometimes ovate, apex acuminate acute or sometimes rounded, base rounded cuneate or subcordate, acutely and finely double-serrate, glabrous or nearly so. Petiole channelled, glabrous or nearly so. Flowers white, .3-.8 inch diameter, on short lateral leafy shoots, solitary or in clusters of 2-3, axillary or terminal. Pedicels about .5 inch long, pubescent or glabrous. Calyx pubescent, lobes caudate-acuminate. Fruit yellow or orange, .5 inch diameter, the columnar receptacle visible between the fruit and the calyx. Drupelets many, glabrous.

Occurs throughout the hills between 5,500 and 9,000 feet. Fairly common in open *banj* and *karshu* forest. Flowers: April-June. Fruit: June-July.

11. *Rubus lasiocarpus*, Smith. Vern. *Kala-hinsālu*, BD. *Kalahissōl*, NG. *Kalhissau*, A.—A large suberect shrub with spreading often arched or straggling stems up to 10 feet high and 1 inch diameter. Stems armed with stout nearly straight spines, smooth, reddish- or purplish-brown with thin white often transparent bloom disappearing with age. Young twigs and petioles sparsely hairy, armed with recurved spines. Leaves on canes of the year up to 10 inches long. Leaves on old canes up to 6 inches long; leaflets 5-7, rarely 13; lateral sessile or subsessile, .7-2 inches long, usually lanceolate; terminal 1-2.5 inches long, rhomboid or ovate, often 3-lobed; all acute, sharply 1- or 2-serrate, glabrous above when mature, with white felted tomentum beneath, lateral nerves impressed above, prominent beneath, straight and parallel. Flowers pink, .3-.5 inch diameter, in axillary or terminal, usually pedunculate, often paniced corymbs. Pedicels tomentose .3-.6 inch long. Calyx densely grey-tomentose inside and outside; lobes lanceolate, acuminate. Petals erect, shorter than the calyx. Fruit black, .3-.5 inch diameter. Drupelets numerous, hoary, succulent.

Occurs throughout the area between 1,500 and 7,500 feet. Common in most types of forest and on waste land. Flowers: March-June. Fruit: June-July.

Var. *rosæfolius* Hook. f.—This variety is very similar to *Rubus lasiocarpus* as described above. It differs however in (1) the glabrous young twigs, (2) the undersurface of the leaf which is glabrous except for a few hairs on the nerves, (3) the glabrescent petioles, (4) the calyx which is glabrous without and clothed with dense felted tomentum within, (5) the caudate-acuminate calyx-lobes, (6) the smaller and more compact inflorescence. It has been collected near Gulabkoti in North Garhwal at 7,000 feet.

There is also another well-marked variety found growing in abundance in the oak forests round Naini Tal between 7,000 and 7,500 feet. This variety chiefly differs from the type as already described in the following points:—(1) the stems seldom exceed 3 feet high and .25 inch diameter, (2) leaflets rarely 7, usually 5, (3) leaflets beneath usually only pubescent on the nerves, the intervening portions glabrous or nearly so, (4) drupelets fewer, larger and less compact, (5) fruit ripens nearly a month earlier.

12. *Rubus rosæfolius*, Smith.—A subdeciduous shrub with weak procumbent or straggling stems 2—5 feet high and up to .5 inch diameter. Bark smooth, green, without bloom, armed with stout recurved prickles. Young shoots purplish with scattered glandular hairs and rather numerous hooked prickles. Leaves 5—10 inches long. Petiole with glandular hairs and hooked prickles. Leaflets 5—7, but sometimes up to 11, subequal the lateral sessile or shortly stalked, 1.5—3 inches long, lanceolate or ovate-lanceolate, acuminate, base obtuse or rounded, doubly inciso-serrate, upper surface with scattered hairs, lower surface glabrous and pale green (not white), lateral nerves straight and parallel. Stipules linear-lanceolate, acuminate, .3—6 inch long. Flowers white, 1.1—2 inches across the spreading petals, axillary and terminal, solitary or in few-flowered panicles. Pedicels .5—2 inches long, with scattered glandular hairs. Calyx glabrescent outside or tomentose near the margin, with dense short felted tomentum inside; lobes caudate-acuminate, much exceeding the petals. Fruit scarlet, .5—1.5 inches diameter. Drupelets very numerous, small, glabrous.

Occurs throughout the hills between 5,500 and 8,000 feet. Local and generally scarce; usually found in shady forest and moist ravines. Flowers: April-May. Fruit: June.

5. SPIRÆA, Linn.

Shrubs or perennial herbs. Leaves alternate, simple or compound, with or without stipules. Flowers in axillary or terminal corymbs or cymes, white or pink. Calyx persistent, lobes 4-5. Petals 4-5. Stamens 20—60, free or connate below, usually inserted on the outer edge of an annular disk. Carpels usually 5, free or connate below. Seeds minute. Follicles usually dehiscent.

I.—Leaves pinnate 1. *Lindleyana*.

II.—Leave simple.

A. Inflorescence corymbose, pedicels normally 1-flowered.

1. Floral shoots 1—3 inches long ... 2. *arcuata*.
2. Floral shoots stemless ... 3. *hypoleuca*.

B. Inflorescence paniculate, lower branches cymose more than 1-flowered.

1. Flowers bisexual, white.

- | | | | |
|---------------------------|-----|-----|--------------------------|
| (a) Ripe carpels villous | ... | ... | 4. <i>canescens</i> . |
| (b) Ripe carpels glabrous | ... | ... | 5. <i>vaccinifolia</i> . |

2. Flowers unisexual, pink

...

6. *bella*.

1. ***Spiræa Lindleyana*, Wall.** Syn. *S. sorbifolia*, Linn. Vern. *Wōpana* or *Bhilōka*, NG.—A large deciduous shrub with stems up to 15 feet high and 4 inches diameter. Stems often procumbent, sending up strong adventitious shoots. Bark of young shoots smooth, peeling off in thin papery strips, becoming roughish and dark brown or grey with numerous conspicuous circular lenticels on old stems. Blaze .2 inch, pinkish-brown densely speckled darker. Leaves pinnate, 10—15 inches long. Leaflets 13—23, 2—4 inches long, sessile, opposite, lanceolate or linear-oblong, base rounded, apex long-acuminate, margin sharply biserrate, the terminal leaflet sometimes lobed or imperfectly divided. Flowers white, .2—.25 inch diameter, in large terminal panicles up to 18 inches long. Fruit of 5 carpels.

Occurs throughout the central and inner ranges from 6,500 to 11,000 feet. Sometimes abundant and more or less gregarious on open boulder-strewn ground and stony talus slopes. Flowers: June-July.

2. ***Spiræa arcuata*, Hook f.** Syn. *S. Zabeliana*, C. K. Schn.—A small deciduous shrub 3—6 feet high with arching stems up to .5 inch diameter. Twigs sparsely hairy or glabrescent. Bark smooth, deep reddish-brown with prominent circular lenticels on the mature wood. Leaves simple, .3—.8 inch long, elliptic or obovate, apex more or less deeply 3—8-toothed or sometimes entire and usually rounded, pubescent when young, glabrous when mature, paler beneath. Petiole up to .1 inch long. Flowers white or tinged with pink, .3-.4 inch diameter, in corymbs terminating short axillary leafy shoots 1—3 inches long. Pedicels up to .5 inch long, pubescent, the lower usually bearing a leafy bract. Calyx-tube pubescent. Disk conspicuous. Ripe carpels not immersed in the calyx-tube, glabrous or pubescent.

Occurs on the inner dry ranges bordering Tibet between 10,000 and 13,000 feet. Fairly common. Flowers: July-August.

3. ***Spiræa hypoleuca*, Dunn.** Syn. *S. diversifolia*, Dunn.—An erect deciduous shrub with stems 2—10 feet high and up to 1 inch diameter. Twigs ribbed, tomentose at first, but soon becoming glabrous. Bark of branches reddish, smooth, becoming grey on old stems. Leaves simple, .7—1.2 by .3—.6 inch, obovate or oblanceolate, apex rounded quite entire or shortly 3-lobed (on vigorous adventitious shoots the leaves often have a rounder form and may be lobed almost to the base, the margin of the lobes becoming crenate and the whole leaf being considerably enlarged. Specimens of such shoots gave rise to the synonym *S.*

diversifolia), glabrous above, tomentose at first and persistently pubescent on the nerves beneath, pale and somewhat glaucous beneath. Petiole up to .2 inch long. Flowers white, .35—.55 inch diameter, in corymbs terminating dwarf axillary shoots which often bear a rosette of leaves. Disk not conspicuous. Pedicels and calyx sparsely hairy or pubescent. Ripe carpels hairy along the ventral suture, not immersed in the calyx-tube.

Occurs along the main Himalayan range between 8,000 and 10,000 feet, but not on the central and outer ranges. It is somewhat gregarious and is usually found growing on limestone, preferring shady forest and north aspects. Flowers: May-June.

4. *Spiræa canescens*, D. Don. Vern. *Mairāla*, NG. *Mairāb*, RK.—An erect deciduous shrub with stems up to 15 feet high and 2.5 inches diameter. Branches usually arching. Twigs densely pubescent when young. Bark reddish-brown or grey, slightly rough with small circular raised lenticels. Blaze less than .1 inch. Leaves simple, .3—.5 inch long (on vigorous adventitious shoots they may attain 1.5 by .75 inch), elliptic obovate or oblanceolate, base usually cuneate, apex rounded, entire or 3—5-toothed at the tip, rather thick, more or less densely and persistently pubescent on both sides, paler beneath. Petiole up to .1 inch long. Flowers white, .3 inch diameter, in cymose panicles terminating short axillary leafy shoots 1—4 inches long, the shoots usually all turned to one side of the branch. Disk conspicuous, yellow. Pedicels and calyx densely tomentose. Ripe carpels villous, half-sunk in the calyx-tube.

Occurs throughout the hills between 5,000 and 10,000 feet. Very common in secondary scrub forest and exposed situations, often on old abandoned cultivation. It is found on all aspects and shows a tendency to gregariousness. Flowers: May-June. Fruit: October-November.

5. *Spiræa vacciniifolia*, D. Don.—A subdeciduous shrub with erect or arching stems 2—6 feet high and up to .35 inch diameter. Bark fairly smooth, dark bluish-grey when old, reddish-brown when young. Leaves simple, variable in size, .5—1.5 inches long (on vigorous adventitious shoots they often attain 2.5 inches long), the flowering shoots usually bearing large leaves, ovate or elliptic-lanceolate, base narrowly or broadly cuneate, apex acute or obtuse, margin crenate or serrate and seldom entire, glabrous above, pale glaucous and glabrous or hairy on the nerves beneath. Petiole .15—.4 inch long. Flowers white, .15—.2 inch diameter, in dense terminal and lateral branched corymbose cymes 1—4 inches across. Pedicels villous. Ripe carpels glabrous, half-sunk in the calyx-tube.

Occurs throughout the hills between 4,500 and 7,500 feet. Very common, with a tendency to gregariousness in open *banj* forest. It is also commonly found growing on banks between cultivation and in scrub forest. Flowers: May-July. Fruit: September-October.

6. *Spiræa bella*, Sims.—A small erect deciduous shrub 2—4 feet high with stems up to .25 inch diameter. Leaves simple, 1—1.5 inches long, ovate elliptic or lanceolate, coarsely serrate especially in the upper half, thin, membranous, pale glaucous beneath, glabrous above, glabrous or hairy on the nerves beneath. Petiole .1— .3 inch long. Flowers unisexual, .3 inch diameter, pink or white tinged with pink, in branched corymbose cymes 1—3 inches across terminating axillary shoots 2—8 inches long. Pedicels villous. Ripe carpels glabrous except for a few hairs on the ventral suture, brown, shining, not sunk in the calyx-tube; styles spreading, as long as the valves.

Occurs on the central and inner ranges between 8,500 and 10,000 feet. Common and often gregarious in silver fir and *Quercus semecarpifolia* forests. Flowers: May—July.

6. POTENTILLA, Linn.

Perennial herbs, rarely shrubs. Leaves digitately or pinnately compound, the leaflets usually lobed; stipules adnate to the petiole. Flowers white or yellow, rarely red, solitary or in corymbose cymes; bracts leafy; bracteoles 5, rarely 4, under the calyx. Calyx persistent; lobes 5, rarely 4, valvate. Petals 5. Stamens many, 1- or more-seriate, rarely definite. Carpels many on a small dry receptacle; ovule solitary; style persistent or deciduous, ventral or terminal. Fruit of many achenes, clustered on the dry receptacle.

I.—Flowers on woody shoots.

1. Leaflets 5—11, .2— .4 inch long ... 1. *fruticosa*.

2. Leaflets 3, .4— .8 inch long ... 2. *rigida*.

II.—Flowers on leafy herbaceous shoots. Leaflets 3 ... 3. *eriocarpa*.

In addition to the above *P. Sibbaldi*, Haller. which has been recorded from the inner ranges between 9,000 and 14,000 feet has a woody rootstock, but practically no stem. It has trifoliate leaves rather similar in shape to those of *P. eriocarpa*, but smaller and clothed with silky hairs. The yellow flowers are about .5 inch diameter in leafy silky cymes.

1. *Potentilla fruticosa*, Linn.—A deciduous shrub 6—18 inches high with densely matted flexible decumbent or creeping stems up to .5 inch diameter. Bark reddish-brown exfoliating in thin papery fibrous strips. Leaflets 5—11, .2— .4 by .05— .15 inch, oblanceolate, apex acute or rounded, densely clothed with white silky hairs on both surfaces, the uppermost pair with decurrent bases, the remaining leaflets whorled about the rachis. Petiole .1— .3 inch long, silky-hairy. Stipules .1— .3 inch long, ovate, brown, membranous, thinly silky-hairy or glabrescent. Flowers yellow, .6—1.2 inches diameter, solitary or 2-3 together at the ends of the branches. Peduncles up to .5 inch long, villous. Bracteoles 5, as long as but narrower than the calyx-lobes, silky on both sides. Calyx-lobes silky without, glabrous within.

Occurs on the drier ranges bordering Tibet between 10,000 and 14,000 feet. Common. Flowers: July-August. The species here described is var. *ochreatea*, Lindl.

2. *Potentilla rigida*, Wall.—A bushy deciduous shrub 1—3 feet high with stems up to 1 inch diameter. Bark very rough, pale buff or cinnamon-brown, peeling off in papery strips. Leaflets 3, 4—8 by 1½—3 inch, narrowly elliptic or oblanceolate, acute, clothed densely above less densely beneath with glistening white silky hairs, the lateral with broad bases. Petiole 1½—6 inch long, silky-hairy. Stipules 3—6 inch long, ovate, brown, membranous, silky-hairy. Flowers yellow, 7—1½ inches diameter, solitary; peduncles up to 1 inch long, villous. Bracteoles 10, in pairs between the calyx-lobes, silky on both sides. Calyx-lobes silky without, glabrous within.

Occurs along the slopes of the main Himalayan range between 8,000 and 12,000 feet. Fairly common on open sunny aspects and on steep rocky ground. Flowers: June—September.

3. *Potentilla eriocarpa*, Wall.—A small deciduous shrub, the twigs densely covered with overlapping stipules. Leaves 3-foliolate. Petiole 1—3 inches long, slender. Stipules about ½ inch long, silky. Leaflets 5—1½ inches long, cuneate and entire in the lower half, deeply incised and toothed in the upper half, glabrous. Flowers 8—1½ inches diameter, yellow, solitary, axillary and terminal, borne on slender herbaceous leafy shoots which arise from the tips of the stout woody branches.

Occurs along the main Himalayan range between 9,000 and 14,000 feet. The plant is sometimes much reduced at high elevations. Flowers: July—September.

7. *ROSA*, Linn. (*The Roses*.)

Erect sarmentose or climbing shrubs, usually prickly. Leaves alternate, imparipinnate; leaflets serrate; stipules adnate to the petiole. Flowers terminal, solitary or corymbose; bracts rarely persistent; bracteoles 0. Calyx-tube with a contracted mouth; lobes 4-5. Petals 4-5, usually large. Disk lining the calyx-tube, thickened in a ring at the mouth. Stamens many, inserted on the disk. Carpels many, rarely few; styles sometimes connate above; ovule solitary. Fruit a fleshy calyx-tube enclosing a cluster of coriaceous or bony achenes.

I.—Erect shrubs.

1. Flowers 5-merous, pink.

- | | | |
|---|-----|-------------------------|
| (a) Leaves 2—8 inches long, leaflets 7—11 | ... | 1. <i>macrophylla</i> . |
| (b) Leaves 1—3 inches long, leaflets 5—9 | ... | 2. <i>Webbiana</i> . |

2. Flowers 4-merous, white or yellow

- | | | |
|------------------------------|-----|----------------------|
| ... | ... | 3. <i>sericea</i> . |
| II.—A climber. Flowers white | ... | 4. <i>moschata</i> . |

1. *Rosa macrophylla*, Lindl. Vern. *Künja*, NG.—An erect deciduous shrub with stems up to 15 feet high and 4 inches diameter. Bark dark purplish-green or nearly black ultimately becoming pale buff on old stems and exfoliating in large papery pieces. Blaze 1—2½ inch, pink, rather fibrous. Prickles nearly straight, brown. Twigs glabrous.

Leaves 2—8 inches long. Petiole pubescent, often prickly. Stipules adnate to the petiole, broad, spreading. Leaflets 7—11, mostly 5—1 inch long, elliptic, usually nearly glabrous, finely simple-serrate almost from the base. Flowers pink, 1—2·5 inches diameter, solitary or corymbose. Peduncles, pedicels and calyx more or less bristly-glandular. Bracts 3—5 inch long, ovate or lanceolate. Calyx-lobes 1·2 inches long, exceeding the petals, tips dilated sometimes toothed. Fruit red, 5—1·5 inches long, irregularly oblong or pyriform, glandular-hairy, fleshy.

Occurs throughout the hills between 6,000 and 12,000 feet. Very common in forests of silver fir, spruce and *karshu*. Flowers: April—June. Fruit: September—November.

2. *Rosa Webbiana*, Wall. Vern. *Shēdum*, Bhotia.—An erect deciduous shrub 5—10 feet high with stems up to 2 inches diameter. Bark of young stems pink or reddish-brown becoming pale brown or ashy on old stems. Twigs glabrous. Prickles numerous, straight or nearly so, at first pink, then bright yellow and finally grey. Leaves usually 1—3 inches long. Petiole glabrous or pubescent, more or less glandular, often prickly. Stipules adnate to the petiole, usually small. Leaflets 5—9, 2—1·3 inches long, suborbicular or obovate, glabrous or pubescent beneath, rather coarsely simple-serrate except towards the base. Flowers pink or deep red, 1—3 inches across, usually solitary. Peduncles and calyx usually bristly-glandular. Bracts variable. Calyx-lobes 5—1·5 inches long, usually with dilated tips. Fruit red, ovoid or globose, 5—1·5 inches long.

Occurs on the dry interior ranges around Niti at the head of the Dhaulī valley in North Garhwal between 9,000 and 13,500 feet. Fairly common on open stony ground associated with *Juniperus macropoda*, *Rosa sericea*, etc. Flowers: June-July.

3. *Rosa sericea*, Lindl. Vern. *Durkunjā*, NG. and RK.—An erect deciduous shrub 5—10 feet high with stems up to 1 inch diameter. Bark of young stems smooth and reddish-brown, becoming silvery-grey or brown on old stems. Twigs glabrous, without bristles, unarmed or with distant prickles. Prickles straight, compressed, as broad at base as long. Leaves 1—3 inches long, not aromatic. Petiole pubescent, rarely prickly. Stipules adnate to the petiole, apiculate, glabrescent. Leaflets 7—9, 5—1 inch long, usually oblong, toothed only towards the blunt apex, glabrous above, glabrous or pubescent beneath with silky midrib, but no minute glands beneath. Flowers white 1·2—2 inches diameter, solitary, ebracteate, scented. Peduncle glabrous, without glandular hairs, 2—·8 inch long. Calyx-tube usually glabrous, lobes long-pointed, densely pubescent. Fruit bright red, 5—·75 inch diameter, globose.

Occurs throughout the hills between 8,000 and 11,500 feet. Common in forest and on open ground. Flowers: May-June. Fruit: October-November.

The plant I have described above seems to agree with the original description of *R. sericea* as given by Lindley. It also agrees with Franchet's *forma glabrescens* as described in his *Plantæ Delavayanæ*, *Plantes de Chine*, 1889; but these descriptions are very meagre.

Var. glandulosa. Vern. *Shēdum*, Bhotia.—An erect deciduous shrub 5—8 feet high. Bark of young stems reddish, becoming grey on old stems. Twigs glabrous, densely clothed with glandular bristles, armed with prickles. Prickles straight, compressed, often as broad as long. Leaves 1-2 inches long, very aromatic. Petiole tomentose, unarmed. Stipules adnate to the petiole, apiculate, glabrous within, tomentose without. Leaflets 7—11, 3—7 inch long, usually oblong, toothed only towards the blunt apex, pubescent or tomentose above, more or less densely hairy with numerous minute yellowish glands beneath. Flowers pale yellow or nearly white, 1.5—2.5 inches diameter, solitary, ebracteate, scented. Peduncle pubescent, with glandular hairs, .5—1.3 inches long. Calyx-tube pubescent; lobes long-pointed, tomentose. Fruit .25—.35 inch diameter, globose or slightly obovoid.

Occurs on the interior drier ranges bordering Tibet between 9,000 and 12,000 feet. Common on open stony ground. Flowers: May—July.

This plant has hitherto been included under *Rosa sericea* Lindl. of which it has been considered a variety. I am inclined to regard it as a distinct species. It does not agree with any of the forms described by Franchet in his *Plantæ Delavayanæ*. It resembles his *forma pteracantha* in the hairy leaves and calyx-tube, but does not possess the greatly elongated and winged prickles.

4. Rosa moschata, J. Herrman.—A large subdeciduous rambling climber with stems up to 5 inches diameter and 50 feet high. Bark rough, dark reddish-brown, exfoliating in thin strips. Blaze .15—.25 inch, pale yellowish-brown, sometimes pink towards the outside, very fibrous. Twigs glabrous. Prickles recurved, brown. Leaves 2—6 inches long. Petioles pubescent, usually prickly. Stipules adnate to the petiole, narrow, glandular. Leaflets 5—9, 1—3 inches long, ovate or ovate-lanceolate, acute or acuminate, glabrous above, puberulous beneath, serrate. Flowers white, fragrant, 1—1.5 inches diameter, in terminal compound corymbs. Peduncles and pedicels grey-pubescent, not prickly or bristly. Calyx-lobes lanceolate, caudate-acuminate, entire or pinnatifid. Fruit orange-red or dull red, globose or ovoid, .3—.6 inch long.

Occurs throughout the hills between 3,000 and 8,500 feet. Very common in *chir* and *banj* forest, especially in depressions and bordering streams. Flowers: April—June. Fruit: October—February.

8. PYRUS, Linn.

Trees or shrubs, usually deciduous. Leaves simple or pinnate. Flowers white, pink or red, in cymes or corymbs usually terminating dwarf side shoots. Calyx-tube usually urceolate; lobes 5, persistent or deciduous. Petals 5. Stamens 20 or more. Disk annular or lining the

calyx-tube. Carpels 2—5, connate, adnate to the calyx-tube; styles free or connate below; ovules 2 in each cell. Fruit a pome, fleshy, 2—5-celled, cells with a cartilaginous or membranous, often 2-valved endocarp.

I.—Leaves simple.

1. Leaves glabrous or glabrescent beneath when mature.
 - (a) Fruit brown, .5—1 inch diameter ... 1. *Pashia*.
 - (b) Fruit red, .3-.4 inch diameter ... 2. *baccata*.
2. Leaves persistently woolly-tomentose beneath.
 - (a) Leaves lobulate ... 3. *lanata*.
 - (b) Leaves not lobulate ... 4. *vestita*.

II.—Leaves pinnate.

1. Inflorescence rusty-tomentose. Leaflets 1-2 inches long ... 5. *foliolosa*.
2. Inflorescence glabrescent. Leaflets .4—1 inch long ... 6. *microphylla*.

1. ***Pyrus Pashia*, Buch.—Ham.** Vern. *Mēhal*, Gen. *Mōhal*, NG. *Mēb*, A.—A small deciduous tree attaining 6 feet girth and 50 feet high. Bark rough, dark brown or blackish, split up by deep cracks and exfoliating in small woody rectangular scales. Blaze .5—-.75 inch, soft, pinkish turning brown on exposure. Stems sometimes armed with stout spines when young. Twigs woolly when quite young, soon becoming glabrous. Leaves simple, 2—4 inches long, lanceolate or ovate-lanceolate, acuminate, sometimes caudate, crenate, woolly when quite young, glabrous and shining above, glabrescent beneath when mature, drying black. Petiole slender, up to 1.5 inches long. On young plants the leaves are often 3—5-lobed and sharply serrate. Flowers white, fragrant, .8—1 inch diameter, in corymbs or umbels. Pedicels .5—2 inches long, woolly. Calyx-tube glabrous or woolly without. Fruit globose, .5—1 inch diameter, brown ultimately turning black, rough with pale raised specks.

Occurs throughout the hills between 2,500 and 8,000 feet. Common in most types of forest found at these elevations. Flowers: February—April. Fruit: December—February.

2. ***Pyrus baccata*, Linn.** Eng. The Siberian Crab.—A small deciduous tree with short bole and rounded crown attaining 5 feet girth and 20 feet high. Bark rough, reddish-brown, exfoliating in thin scales. Blaze .2—-.25 inch, yellow. Twigs sparsely hairy when young, soon becoming glabrous. Old stems usually armed with stout, simple or branched spines 1—3 inches long. Leaves simple, 2—4 inches long, usually elliptic, acute or shortly acuminate, finely crenate-serrate, at first pubescent on the nerves on both faces ultimately quite glabrous. Petiole .5—1 inch long, pubescent at first, glabrous or glabrescent when mature. Flowers white, .75—1 inch diameter, in umbels or fascicles on short

lateral leafy shoots. Pedicels slender, glabrous, 1—1.75 inches long. Calyx-tube glabrous, .1 inch long; lobes lanceolate-acute, .2-.3 inch long, glabrous without, tomentose within. Fruit red, .3-.4 inch diameter, ovoid or globose, smooth.

Occurs throughout the hills between 5,500 and 8,500 feet. Scarce, particularly in the outer ranges. Generally found in open forest. Flowers: April. Fruit: October—November.

There is a variety found at about 9,000 feet which differs very markedly from the usual form which I have described above, and it will repay further investigation. In this variety the petioles midrib and nerves beneath are densely tomentose. Pedicels and calyx-tube are also densely tomentose. The fruit is somewhat larger and slightly rough, reddish-green with a few white spots (*Lambert*). From the herbarium material available the leaves appear to be also larger and more acuminate.

3. *Pyrus lanata*, D. Don. Vern. *Galao*, NG. *Maul*, CA.—A small deciduous tree attaining 4 feet girth and 30 feet high. Bark rough, exfoliating in thin woody pieces. Blaze .5 inch, pinkish-brown. Twigs clothed when young with deciduous white wool, ultimately becoming glabrous and shining. Leaves simple, about 3—6 inches long, broadly ovate, or elliptic, loosely woolly above when quite young, glabrous except sometimes on the midrib when mature, white-woolly beneath; margins lobulate and serrate, lateral nerves 8—12 pairs. Petiole .2—1 inch long, stout, woolly. Flowers white, scented, .6—1 inch diameter, in terminal or subterminal woolly corymbs. Calyx-lobes lanceolate, acute, .1 inch long, glabrous outside, woolly within. Fruit about 1 inch long, globose or pyriform, orange-yellow usually tinged with red and speckled with small dots.

Occurs throughout the central and main Himalayan ranges between 8,000 and 10,000 feet. Often associated with silver fir or *karshu*, but though fairly common in certain localities is generally local in its distribution. Flowers: April-May. Fruit: October-November.

4. *Pyrus vestita*, Wall. Vern. *Mōli*, G.—A medium-sized deciduous tree with spreading crown and short bole attaining 9 feet girth and 60 feet high. Bark rough on old stems, dark grey or silvery often deeply cracked and furrowed, exfoliating in thin scales. Blaze .5—1.5 inches, purplish-brown, rather soft. Leaves simple, 4—9 by 2—4.5 inches, broadly ovate or elliptic, densely white-woolly above when quite young, eventually becoming glabrous or glabrescent, white-woolly beneath, margin with somewhat irregular small serrations, the basal portion often entire, apex usually acute, lateral nerves 10—14 pairs. Petiole .3—.5 inch long, stout, woolly. Flowers white, .6 inch diameter, in terminal woolly corymbs. Calyx-lobes woolly without and within. Fruit .5—.75 inch diameter, globose, greenish-yellow often tinged with red and covered with small brown spots.

Occurs throughout the central and main Himalayan ranges between 8,000 and 10,000 feet. Common in silver fir and *karshu* forests. Flowers: May-June. Fruit: October-November.

5. *Pyrus foliolosa*, Wall. Vern. *Saulu* or *Ghiya*, NG.—A large deciduous shrub usually 6—10 feet high, but stems attain 25 feet high and 12 inches diameter. At high elevations the stems form a knotted mass arching upwards. Bark of young stems smooth, pale often silvery and sometimes reddish, of old stems rough exfoliating in thin flakes. Blaze .25—.5 inch, with short fibre, pinkish, almond-scented. Leaves pinnate, 5—10 inches long; rachis rusty-tomentose beneath, narrowly winged. Stipules small, foliaceous. Leaflets 17—25, linear-oblong, 1-2 by .25—.5 inch, shining and glabrous above or pubescent on the midrib, pale and glabrous beneath or more often tomentose on the midrib, sharply serrate in the upper half with a prominent apiculate tip. Flowers .3—.35 inch diameter, white or sometimes pink, fragrant, in dense branched corymbs 2-3 inches long, the branches rusty-tomentose, bearing conspicuous hairy bracts up to .6 inch long, which fall off after flowering. Calyx green. Fruit globose, .2—.5 inch diameter, glabrous, pink or white.

Occurs throughout the main Himalayan range between 9,000 and 13,000 feet. Very common as an associate of *Betula utilis*, *Rhododendron campanulatum* or *Abies Webbiana*. Often forming gregarious undergrowth, especially on north aspect. Flowers: May-June. Fruit: September-October.

6. *Pyrus microphylla*, Wall. Vern. *Saulu* or *Halão*, NG.—A large deciduous shrub, the stem attaining 12 feet high and 3 inches diameter, the lower portion often procumbent and arching upwards. Bark smooth, light grey or reddish-brown. Leaves pinnate 2.5—7 inches long; rachis glabrous beneath, narrowly winged. Stipules small, foliaceous. Leaflets 17—29, elliptic or oblong, .4—1 by .2—.4 inch, upper surface glabrous or nearly so, lower surface glabrous, margin sharply serrate except at the base, apex rounded not apiculate. Flowers .3-.4 inch diameter, pink or occasionally white, fragrant, in sparingly-branched corymbs 1.5—3 inches long, the branches glabrescent or with scattered long hairs, bearing small linear glabrous bracts up to .2 inch long which fall off before the flowers open. Fruit .3 inch long, oblong or globose, glabrous, pinkish.

Occurs throughout the main Himalayan range between 10,000 and 12,500 feet in similar localities to *P. foliolosa*, but whereas *P. foliolosa* is commoner on the southern spurs of the main range, *P. microphylla* is commoner on the dry ranges to the north. The two species, though often found growing together, are I think distinct in this area, though there may be intermediate forms elsewhere. Flowers: May-June. Fruit: September-October.

9. STRANVÆSIA, Lindl.

Trees or shrubs. Leaves simple, entire or serrulate. Flowers in corymbs. Calyx-tube obovoid; limb dilated, 5-toothed. Petals 5, obovate. Stamens 20, inserted in the mouth of the calyx. Ovary

5-celled; styles 5, connate half way up; stigma 2-fid; ovules 2 in each cell. Fruit subglobose, 5-celled; endocarp crustaceous, dehiscing longitudinally.

***Stranvæsia glaucescens*, Lindl.** Vern. *Gadh-mēhal*, G. *Garmal*. A.—A medium-sized evergreen or subdeciduous tree with rather dense crown attaining 6·5 feet girth and 70 feet high. Young plants and adventitious shoots sometimes armed with stout straight spines up to 2 inches long. Bark reddish-brown, rough, exfoliating in irregular woody strips and scales. Blaze ·35—·5 inch, soft, pink turning orange-brown on exposure. Leaves 3·5—6·5 by 1·25—2·25 inches, oblanceolate or obovate, apex abruptly acute or sometimes rounded, margin finely serrate often entire towards the base, rarely quite entire, coriaceous, downy beneath when quite young, soon becoming glabrous on both surfaces, glossy dark green above, pale and glossy beneath when mature, secondary nerves indistinct. Petiole ·4—·8 inch long. Flowers white, scented, ·5—·7 inch diameter, in terminal branched corymbs 2—4 inches across, the lower branches often axillary, branches clothed with white woolly deciduous tomentum. Fruit 2—5 inch diameter, globose or ovoid, apex truncated, orange, woolly-tomentose at first becoming glabrous or sparsely downy when ripe.

Occurs throughout the hills between 2,500 and 7,000 feet. Fairly common along ravines in *banj* or *chir* forest. Flowers: May-June. Fruit: October-January.

10. CRATÆGUS, Linn.

Shrubs or small trees, often thorny. Leaves usually deciduous, simple; stipules deciduous. Flowers white or red, in terminal corymbose cymes, rarely solitary. Calyx-tube contracted at the mouth; lobes 5, persistent or deciduous. Petals 5, inserted at the mouth of the calyx-tube. Stamens usually many. Carpels 1—5, adnate to the calyx-tube; styles as many as carpels, free or more or less united; ovules 2 in each cell. Fruit formed from the enlarged calyx-tube, containing a bony 1—5-celled stone, or 1—5 separate one-seeded pyrenes.

***Cratægus crenulata*, Roxb.** Vern. *Ghingāru*, G.—An evergreen shrub with stems up to 15 feet high and 9 inches diameter, armed with stout spines. Bark pale brown, fairly smooth. Blaze ·25—·35 inch, with very short fibre, pink turning orange-brown on exposure. Leaves simple, 1—3 by ·3—·7 inch, linear-oblong or oblong-lanceolate, crenulate, coriaceous, shining dark green above, glabrous, apex usually obtuse, base narrowed into a marginate and channelled petiole ·1—·4 inch long. Flowers white, ·2·3 inch diameter, in many-flowered terminal corymbose

cymes, the lower branches axillary. Fruit 2—4 inch diameter, globose, apex more or less truncated, smooth, glabrous, scarlet.

Occurs throughout the hills between 2,000 and 7,000 feet. Common on waste land, also in *chir* and *banj* forest, but especially along the banks of open streams and in such localities it is somewhat gregarious and sometimes forms dense thickets. Flowers: April-May. Fruit: July—November.

11. COTONEASTER, *Medik.*

Small trees or shrubs, erect or decumbent. Leaves alternate, simple, entire; stipules deciduous. Flowers small, solitary or in cymes, white or pink. Calyx-tube turbinate or campanulate; lobes 5, persistent. Petals 5. Stamens indefinite, usually 20, inserted at the mouth of the calyx-tube. Carpels 2—5, adnate to the calyx-tube; styles free; ovules 2 in each cell. Fruit a drupe with 2—5 one-seeded pyrenes.

I.—Corolla erect in flower, flowers not opening widely, usually pink. Fruit red when ripe.

A. Leaves usually less than 5 inch long ... 1. *disticha*.

B. Leaves usually more than 5 inch long.

1. Cymes loose, 3-many-flowered.

(a) Leaves glabrous or nearly so ... 2. *rosea*.

(b) Leaves tomentose beneath ... 3. *obovata*.

2. Cymes 1—5-flowered.

(a) Leaves adpressed-hairy, greatest width below the middle, apex acute ... 4. *acuminata*.

(b) Leaves more or less tomentose beneath, mostly rounded at both ends... 5. *integerrima*.

II.—Corolla spreading, flowers opening widely, usually white.

A. Leaves less than 8 inch long.

1. A low or prostrate shrub. Flowers 1—3 together ... 6. *microphylla*.

2. An erect shrub 6—10 feet high. Flowers 5—8 together ... 7. *sp.*

B. Leaves more than 8 inch long.

1. Fruit black when ripe.

(a) Inflorescence puberulous ... 8. *bacillaris*.

(b) Inflorescence densely woolly-tomentose ... 9. *Lindleyi*.

2. Fruit scarlet when ripe ... 10. *frigida*.

1. **Cotoneaster disticha**, *Lange*. Vern. *Kautia*, Bhotia.—A low or prostrate rigid much-branched deciduous shrub, the stems attaining 2 feet high and 5 inch diameter. Bark slightly rough, dark grey or pale brown. Twigs clothed with white adpressed hairs, becoming glabrous. Leaves 2—5 inch long (or up to 8 inch on vigorous shoots) varying from broad elliptic with acute ends to orbicular with rounded ends, mucronate, margins not recurved, glabrous above, glabrescent or with

a few long hairs beneath. Petiole up to .1 inch long. Flowers pink or red, .25 inch diameter, solitary on short lateral leafy shoots. Calyx-tube and -lobes sparsely hairy outside. Fruit .3-.4 inch long, turbinate, scarlet, glabrous or nearly so.

Occurs in the interior drier valleys between 10,000 and 12,000 feet. Sometimes in *deodar* or blue pine forest, but more often on open grassy or rocky slopes. Flowers: June. Fruit: September-October.

2. *Cotoneaster rosea*, Edgew.—An erect deciduous shrub 6—10 feet high. Twigs sparsely hairy when quite young. Leaves .5—2 by .3—1 inch, elliptic, thin, membranous, dark green above and pale beneath, base rounded or obtuse, mucronate, slightly hairy on the midrib above and ciliate when young, almost glabrous beneath. Petiole .1—.25 inch long. Flowers pink, .25 inch diameter, in lax 3—10-flowered cymes, .5—1 inch long. Peduncle and pedicels usually glabrous. Calyx-tube and -lobes usually quite glabrous outside. Fruit bright red.

Has been collected near Kurkutti in the Niti valley where it was found growing in open *deodar* forest at 10,500 feet. In the Punjab it is found between 8,000 and 11,000 feet. Flowers: May-June.

3. *Cotoneaster obovata*, Wall.—An erect deciduous shrub up to 8 feet high with long sparingly-branched shoots. Twigs densely hairy when young. Leaves usually .8—2 by .6—1.2 inches, but variable and occasionally up to 4 by 2.7 inches, elliptic, usually rounded at both ends (apex more acute in Garhwal specimens), clothed with long loose hairs on the midrib above, densely grey- or nearly white-tomentose beneath. Petiole .2—.5 inch long. Flowers pink, .3 inch diameter, in cymes usually much-branched and many-flowered. Calyx-tube and lobes tomentose without. Fruit red, pyriform.

Has been collected at 9,800 feet in the Niti valley opposite Laung village, where it was found growing in scrub forest mixed with blue pine. In Chamba it is found from 7,000 to 11,000 feet. Flowers: May-June.

4. *Cotoneaster acuminata*, Lindl. Vern. *Cham-ruins* or *Kuish*, NG.—An erect deciduous shrub 4—12 feet high with flexible sparingly-branched stems up to 1 inch diameter. Stems often bent over by snow. Bark smooth, ash^y or pale brown. Young twigs densely clothed with pale yellowish-grey bristly hairs. Leaves 1.2-.5 by .4—1 inch (on vigorous shoots up to 3.5 by 1.5 inches), ovate or lanceolate, base rounded or broadly cuneate, tapering from somewhat below the middle to a long point, mucronate, hairy especially on the midrib beneath and with scattered adpressed hairs above, ciliate. Petiole up to .2 inch long. Flowers .3—.35 inch diameter, pink or white tinged with pink, in 1—5-flowered cymes .5 inch long. Peduncle and pedicels short, clothed as

also the calyx-tube with bristly hairs. Fruit red, .3 inch long, turbinate.

Occurs throughout the central and inner ranges between 7,000 and 10,500 feet. Common, especially as an undershrub in *karshu* forest. The leaves usually turn red before falling. Flowers: May-June. Fruit: September-November.

5. *Cotoneaster integerrima*, Medik. Syn. *C. vulgaris*, Lindl.—An erect deciduous shrub. Young twigs densely grey-hairy, becoming glabrous. Leaves 1-2 by .7—1 inch, broadly ovate or elliptic, usually rounded at both ends, mucronate, dull green above and paler beneath, glabrous or hairy along the midrib above, ciliate, more or less grey-tomentose beneath. Petiole .1—.3 inch long. Flowers pink, .25 inch diameter, in 1—4-flowered cymes .5—7 inch long. Pedicels hairy. Calyx-tube and -lobes glabrous or with a few long hairs. Fruit .2-.3 inch long, obovoid, deep orange-red.

Has been collected at 13,000 feet near Rimkim beyond the Chor-Hoti pass near the borders of Tibet. Here it was found growing as a low shrub not exceeding 2 feet high, the branches spreading over the ground surface. In the Punjab Himalaya it is found down to 7,500 feet. Flowers: May-June. Fruit: August-September.

6. *Cotoneaster microphylla*, Wall. Vern. *Ghēri*, A. *Bugarchilla*, G.—A low or prostrate rigid much-branched evergreen shrub with stems up to 12 inches high and .5 inch diameter. Twigs sparsely hairy, becoming glabrous. Leaves variable in size, usually .2—.4 inch long, oblong, obovate or elliptic, coriaceous, shining and nearly glabrous above except on the depressed midrib, pale and more or less bristly-hairy beneath, margins recurved ciliate, apex rounded retuse or apiculate, base cuneate or rounded. Petiole up to .1 inch long. Flowers white, .3-.4 inch diameter, 1—3 together usually solitary. Calyx-tube and -lobes densely hairy. Fruit .2-.3 inch diameter, turbinate, scarlet.

Occurs throughout the hills between 4,500 and 11,500 feet. Very common on open grassy and rocky slopes and in blanks in forest, often gregarious. The creeping stems often produce roots. Flowers: April-June. Fruit: September-February. I have not distinguished *C. thymifolia*, Baker (in F. B. I.) from the type, and the two do not appear to be separable either in the field or herbarium by any important character.

Var. ***buxifolia***. (sp. Wall. in F. B. I. ex parte.)—This variety is usually distinguishable in the field without difficulty. It has a stouter stem which may reach 3 feet high and 1 inch diameter, larger leaves, namely .3—.75 by .2—.35 inch, and a larger fruit which averages .3-.4 inch diameter. Though common, it is not so abundant as the type and has not been recorded by me below 6,500 or above 9,500 feet.

7. *Cotoneaster* sp. Vern. *Bānchra*, Bhotia.—An erect shrub 6—10 feet high with rigid branches. Bark smooth, reddish-brown or grey. Twigs densely grey-tomentose when young. Leaves .3—.6 by .2-.3 inch, oblong or obovate, base narrowed into the petiole, apex

rounded mucronate, coriaceous, glabrous above, densely tomentose beneath. Petiole up to .05 inch long. Flowers white, scented, .3 inch diameter, in dense branched cymes of about 5—8 flowers up to .6 inch long. Branches of inflorescence, calyx-tube and lobes outside thinly woolly. Fruit red.

The above description is based on two specimens (Nos. 359 and 751) which I collected in the Dhauli valley, North Garhwal, and which do not quite agree with any described species. It comes nearest to *C. nummularia*, Fisch. and Mey., but differs from this in the more numerous-flowered cymes, the number of flowers varying from 2—5 in *C. nummularia*. I doubt if true *C. nummularia* is found so far east as Kumaon, though recorded from Kumaon by Duthie. He however probably based his record on his No. 5531 in Kew Herb. collected by him above Chalek in Byans, and this specimen though named by him *C. nummularia* is I believe *C. buzifolia*, Wall. which I have included under *C. microphylla*, Wall.

The shrub is fairly common between 7,000 and 11,000 feet in the Dhauli valley on open rocky ground or in open deodar forest. Flowers: April-May. Fruit: August-September.

8. *Cotoneaster bacillaris*, Wall. Vern. *Ruins*, G and NT.—An erect deciduous shrub with stems up to 20 feet high and 9 inches diameter. Bark rough, reddish-brown, exfoliating in irregular thin pieces. Branches smooth, ashy-brown. Twigs sparsely hairy or grey-tomentose when quite young. Blaze .25—.35 inch, soft, not fibrous, pink with darker streaks which turn orange-brown on exposure. Leaves 1.5—3 by .75—1.5 inches, elliptic or oblanceolate, base narrowed into the petiole, tip rounded or acute, often mucronate, glabrous or pubescent on the midrib above, glabrous or pubescent beneath, quite glabrous on both surfaces when mature. Petiole .2—4 inch long. Flowers white, .25—.3 inch diameter in few- or many-flowered branched cymes .5—1.5 inches across. Branches of inflorescence, calyx-tube and lobes puberulous. Fruit unglossed black, .2—.35 inch diameter, globose, contrasting with the pink pedicels.

Occurs throughout the hills between 6,000 and 8,000 feet. Common in secondary-growth forest near villages and sometimes gregarious. Punjab specimens are often more hairy, but the description here given covers I think the variations found in this area, to which I have confined myself owing to the confusion among the species of this genus. Flowers: April—June. Fruit: September—February.

9. *Cotoneaster Lindleyi*, Steud. Vern. *Dhuins*, Bhotia.—A deciduous shrub with spreading branches up to 12 feet high and 6 inches diameter. Bark of young stems and branches quite smooth, becoming somewhat rough and pale grey when older. Twigs densely grey-tomentose when young. Leaves .8—2 by .5—1.75 inches, broadly elliptic or obovate, glabrescent or hairy above becoming glabrous when mature, persistently more or less tomentose beneath, base usually rounded, apex usually rounded sometimes retuse, mucronate. Petiole

·1—·3 inch long. Flowers white, ·3—·35 inch diameter, in few-flowered branched cymes ·5—1 inch across. Branches of inflorescence, calyx-tube and -lobes densely woolly-tomentose. Fruit black.

Occurs in the dry inner valleys bordering Tibet between 7,500 and 10,500 feet. Found associated with *deodar* and blue pine, but is not common. I am a little doubtful whether this is true *C. Lindleyi*; it is very close to *C. bacillaris*, but differs from Kumaon specimens of the latter in its hairier leaves and inflorescence. Flowers: May-June. Fruit: September.

10. *Cotoneaster frigida*, Wall.—A deciduous shrub or small tree up to 12 inches diameter and 20 feet high. Bark pale grey. Twigs densely grey-tomentose when young. Leaves 2—4 by 1—1·7 inches, oblong-lanceolate or elliptic, base narrowed into the petiole, apex rounded mucronate, upper surface glabrous or pubescent on the midrib, lower surface more or less woolly-tomentose especially on the midrib when quite young soon becoming glabrous except the midrib. Petiole ·15—·4 inch long. Flowers white, ·2—·25 inch diameter, in numerous-flowered much-branched cymes 1·5—2·5 inches across. Branches of inflorescence, calyx-tube and -lobes densely woolly-tomentose. Fruit globose, about ·2 inch diameter, scarlet.

Occurs along the Dhauli valley of North Almora at 10,000 feet. Flowers: July-August.

XXXV.—SAXIFRAGACEÆ.

Trees, shrubs or herbs. Leaves alternate with stipules adnate to the petiole or 0, or opposite and exstipulate. Flowers usually hermaphrodite, regular. Calyx usually 5-merous, more or less adnate to the ovary. Disk cup-like or sometimes reduced to intra-staminal glands. Petals usually 5, rarely 0, usually perigynous, imbricate or valvate. Stamens inserted with the petals, equalling or double their number, rarely indefinite. Carpels usually 2, less often 3—5, united in a usually 2-rarely 3—5-celled ovary, with axile placentae, sometimes 1-celled with parietal placentae; ovules many. Fruit an indehiscent capsule or an indehiscent berry.

I.—Leaves opposite.

- A. Flowers in large terminal corymbose cymes, inconspicuous, but usually with a few large conspicuous sterile outer flowers ... 1. *Hydrangea*.
- B. Flowers conspicuous, white, in small terminal inflorescences, no sterile flowers.
 - 1. Stamens 10. Hairs stellate ... 2. *Deutzia*.
 - 2. Stamens 20—40. Hairs simple ... 3. *Philadelphus*.

II.—Leaves alternate.

- 1. Leaf-base 1-nerved. Fruit a capsule ... 4. *Itea*.
- 2. Leaf-base 3—5-nerved. Fruit a berry ... 5. *Ribes*.

I. HYDRANGEA, Linn.

Erect or climbing shrubs or trees. Leaves opposite, exstipulate. Flowers in terminal corymbs, the outer flowers often sterile and larger than the fertile inner flowers. Calyx-tube adnate to the ovary, turbinate or hemispherical; limb truncate or 4-5-toothed. Petals 4-5, valvate. Sterile flowers apetalous, but calyx-limb with 4-5 large petaloid veined segments. Stamens 8—15, inserted at the base of an epigynous disk. Ovary inferior, more or less incompletely 2—4-celled; styles 2—4, free or connate at the base; ovules numerous. Fruit a membranous capsule, crowned by the calyx-limb and the persistent styles, 2—4-celled.

- I.—A climber ... 1. *altissima*.

II.—Erect trees or shrubs.

- 1. Petiole .5—1.2 inches long. Upper surface of mature leaves with scattered adpressed hairs over the whole surface ... 2. *aspera*.
- 2. Petiole 1.2—2.5 inches long. Upper surface of mature leaves glabrescent or puberulous on the nerves ... 3. *vestita*.

1. *Hydrangea altissima*, Wall.—A large deciduous climber, climbing by means of adventitious roots. Bark pale brown, flaking off in long papery strips. Leaves 3—7 by 2—4·5 inches, ovate, acuminate, thin, membranous, serrate, glabrous except in the axils of the nerves and sometimes along the main nerves. Petiole 1—3 inches long, base sub-amplexicaul, hairy. Flowers in terminal hairy corymbose trichotomous cymes 4—6 inches across; usually some of the outer flowers sterile, .8—1·2 inches diameter, with enlarged white suborbicular or broadly elliptic petaloid calyx-lobes; fertile flowers .1 inch diameter, greenish, scented. Bracts, the lower 1·5 inches long, lanceolate, acuminate; bracteoles .1 inch long, linear; all caducous. Petals falling off in a calyptra. Stamens 10—15, conspicuous. Capsule .15 inch diameter, subhemispheric, truncate.

Occurs throughout the central and inner ranges between 5,000 and 9,000 feet. Common in shady ravines in oak forest. Flowers: May-June.

2. *Hydrangea aspera*, Don.—A deciduous shrub 5—10 feet high with stems up to 4 inches diameter. Bark pale buff or pale brown, peeling off in thin papery scales. Branches covered with small circular lenticels. Blaze .1 inch, pale greenish or pinkish. Young shoots densely adpressed-hairy. Leaves 6—10 by 2·5—4 inches, elliptic or oblong, closely dentate, acuminate, base rounded or acute, with scattered adpressed hairs above, rather densely clothed with spreading hairs beneath, undersurface whitish, with 7—10 pairs of arcuate lateral nerves. Petiole .5—1·2 inches long, hairy. Flowers in terminal tomentose trichotomous corymbose cymes 6—10 inches across, the lower branches usually in the axils of reduced lanceolate leaves; some of the outer flowers sterile, 1-1·8 inches across with enlarged white suborbicular or broadly elliptic petaloid calyx-lobes which are sparsely hairy at first; fertile flowers .2 inch diameter. Bracts; the lower .6-.7 inch long, lanceolate, acuminate; bracteoles .1—.3 inch long, linear-lanceolate; all densely hairy and caducous. Petals expanding, not falling off in a calyptra. Capsule .1—.15 inch diameter, subhemispheric, truncate.

Occurs on the slopes of the main Himalayan range between 4,000 and 7,000 feet. Rather scarce, usually found in shady moist ravines. The leaves turn yellow before falling. Flowers: July. Fruit: December—February.

3. *Hydrangea vestita*, Wall.—A large deciduous shrub 5—15 feet high or occasionally a small tree up to 3 feet girth and 20 feet high. Bark pale brown, rough, exfoliating in small somewhat corky scales. Twigs quite smooth, pale brown, with prominent distant circular raised lenticels and large pith. Blaze .25 inch, white, with a rather slimy juice. Leaves 6—12 by 3·5—5 inches, broadly elliptic, closely dentate

the teeth mucronate, shortly acuminate, base usually acute rarely subcordate, puberulous above becoming dull green and glabrescent when mature, rather densely white-tomentose beneath, with 8—11 pairs arcuate secondary nerves. Petiole 1·2—2·5 inches long, hairy, pink or red, grooved, base sub-amplexicaul. Flowers in terminal tomentose trichotomous corymbose cymes 6—8 inches across; some of the outer flowers sterile, 1·1·8 inches diameter with enlarged white suborbicular or broadly elliptic petaloid calyx-lobes. Petals expanding, not falling off in a calyptra. Capsule 1—1·5 inch diameter, subglobose, the upper third truncate and crowned by a disk formed by the bases of the (usually 3) persistent styles.

Occurs on the slopes of the main Himalayan range between 8,000 and 11,000 feet. Fairly common in silver fir and *karshu* forests on north aspects. The leaves turn bright yellow before falling. Flowers: July-August. Fruit: November-December.

2. DEUTZIA, Thunb.

Deciduous shrubs, usually clothed with stellate hairs. Leaves opposite; stipules 0. Flowers hermaphrodite, white, axillary, solitary or corymbose. Calyx-tube campanulate, adnate to the ovary, thickened and hardened in fruit; lobes 5, valvate. Petals 5. Stamens 10, rarely 12—15; filaments often with 2 teeth. Ovary 3—5-celled, inferior; styles 3—5; ovules numerous, axile. Capsule splitting septicidally from below upwards into separate carpels which dehisce at the apex, but remain attached to the axis.

Leaves green beneath. Calyx-lobes blunt 1. *corymbosa*.

Leaves grey beneath. Calyx-lobes acute 2. *staminea*.

1. **Deutzia corymbosa**, R. Br.—A deciduous shrub 5—10 feet high. Bark smooth, cinnamon-coloured or pale buff, peeling off in papery masses. Leaves 1·5—3·5 by 1—1·5 inches, ovate-lanceolate, long-acuminate, closely serrate, sparsely hairy on both sides or glabrous beneath, hairs stellate, lower surface green not glaucous. Petiole 1—4 inch long. Flowers 1·5—2 inch diameter, white, faintly scented in erect, open, terminal, trichotomous, corymbose panicles 1·5—3 inches long. Pedicels slender, 2—4 inch long. Petals obovate. Capsule 2 inch diameter, truncated globose, stellately hairy.

Occurs along the main Himalayan range between 7,000 and 10,000 feet, but has not been recorded from the central and outer ranges. Fairly common in shady ravines and dense forest. Flowers: May-June.

2. **Deutzia staminea**, R. Br. Vern. *Gūgti*, NG. *Dhaniāla*, NG. and RK.—A deciduous shrub 4—8 feet high with stems up to 1 inch diameter. Bark pale brown, rough, rather fibrous. Leaves 1—3 by 1·4—1·5 inches, lanceolate or ovate-lanceolate, acuminate, minutely

serrate, scabrid above, grey-tomentose beneath, hairs stellate. Petiole .1—·3 inch long. Flowers .6—1·3 inches diameter, white, usually sweet-scented, in terminal trichotomous panicles .5—2·5 inches long. Pedicels .1—·2 inch long. Calyx-teeth triangular to linear-lanceolate, acute. Petals oblong. Capsule .1—1·5 inch diameter, truncated globose, stellately hairy.

Occurs throughout the hills between 3,000 and 8,500 feet. Very common, usually in open situations. Flowers: April—June.

D. macrantha, H. f. & T. is the name given to a plant collected at 5,500 feet below Binsar in Almora by Strachey and Winterbottom. The inflorescence is described in the F. B. 1 as a large 8-flowered corymb, with linear calyx-teeth, but in other respects the description does not materially differ from that given above for *D. staminea*. I have seen the type specimen at the Kew Herbarium and I believe it to be only a large-flowered and vigorous form of *D. staminea*.

3. PHILADELPHUS, Linn.

Shrubs. Leaves opposite, exstipulate. Calyx-tube turbinate, adnate to the ovary; lobes 4, rarely 5, valvate. Petals 4, rarely 5, convolute in bud. Stamens 20—40, inserted under the edge of the epigynous disk. Ovary 3—5-celled; styles 3—5; ovules numerous. Capsule turbinate 3—5-celled; dehiscing loculicidally.

Philadelphus tomentosus, Wall. Syn. *P. coronarius*, Linn. var. *tomentosus*, C. B. Clarke.—A deciduous shrub 6—12 feet high with stems up to 2 inches diameter. Bark pale brown, slightly rough, exfoliating in thin strips. Leaves 2—4 by .8—2 inches, ovate-lanceolate, long-acuminate, irregularly and rather distantly serrate, thin, membranous, glabrous above when mature, glabrous or tomentose and paler beneath, hairs simple; lateral nerves 2 pairs, sub-basal, arcuate. Petiole .3—·5 inch long. Flowers .6—1·4 inches diameter, white, fragrant, 3—7 at the ends of the branches, 3 terminal with or without 1-2 pairs in the axils of the upper leaves. Pedicels .3—·5 inch long. Capsule .5 by .3 inch, the basal two-thirds enclosed within the calyx-tube with its persistent lobes, the upper free portion rounded and terminating in the persistent styles. Seeds minute, numerous.

Occurs along the slopes of the main Himalayan range between 7,000 and 9,000 feet, but not recorded from the central and outer hill ranges. Rather scarce. Generally in shady forest. Flowers: May—July. Fruit: October–November.

4. ITEA, Linn.

Shrubs or trees. Leaves alternate, petioled. Flowers in racemes. Calyx-tube adnate to the base of the ovary; lobes 5. Petals 5, perigynous, white, valvate. Stamens 5. Ovary half-superior, 2-celled; ovules many, axile. Capsule many-seeded, splitting through the dissepiments and the style.

***Itea nutans*, Royle.**—A shrub or small tree up to 15 feet high and stem up to 6 inches diameter. Bark fairly smooth, reddish-brown. Blaze .1 inch, white or pinkish. Branches lenticellate. Young shoots glabrous or pubescent. Leaves 4—6 by 1.5—2.5 inches, elliptic-oblong or elliptic, acuminate, serrate, glabrous on both surfaces or softly pubescent beneath, with scattered hairs on the nerves above when young, thin, glossy above when mature (and beneath also in the glabrous form), with 4—7 pairs of arcuate secondary nerves and numerous fine transverse veins between. Petiole .5—1 inch long, glabrous or pubescent. Flowers .1—1.5 inch long, pale greenish, in fascicles of 2—5, in long slender drooping spike-like terminal racemes 4—9 inches long. Pedicels .05—1 inch long, pubescent. Sepals and petals persistent. Capsule .1 inch long, splitting into 2 valves which adhere by the bases and stigma.

Occurs probably throughout the area, though not yet recorded from some Divisions. It is found between 2,000 and 6,000 feet and is rather scarce. The glabrous form has been found in the outer ranges, the hairy form in the inner ranges. Flowers : May-June.

5. RIBES, Linn.

Shrubs mostly deciduous, sometimes prickly. Leaves simple; stipules 0. Flowers usually small, hermaphrodite or polygamo-dioecious, in racemes, rarely solitary or clustered. Calyx 4-5-merous, the tube adnate to or produced above the ovary, lobes more or less petaloid. Petals 4-5, inserted at the mouth of the calyx-tube. Stamens 4-5. Ovary inferior, 1-celled; styles 2, more or less united; ovules numerous on two parietal placentæ. Fruit a berry tipped with the persistent calyx.

I.—Prickly. Flowers solitary or clustered ... 1. *Grossularia*.

II.—Unarmed. Flowers in racemes.

A. Calyx-limb short, spreading.

1. Leaves sticky-glandular with obtuse lobes ... 2. *orientale*.

2. Leaves with few or no glandular hairs and acute lobes.

(a) Leaves 1.2-5 inches long ... 3. *glaciale*.

(b) Leaves 2.5—6 inches long ... 4. *acuminatum*.

B. Calyx-limb campanulate or tubular ... 5. *rubrum*.

1. ***Ribes Grossularia*, Linn.** Vern. *Chapchu* or *Lipchi*, Bhotia. Eng. The Gooseberry.—A stiff erect deciduous shrub 4-5 feet high, armed beneath the buds with 1—3, usually 3, straight strong prickles up to .7 inch long. Bark dark grey, exfoliating in papery rolls. Twigs furrowed, pubescent or tomentose when young, bearing inconspicuous gland-tipped hairs or prickly bristles. Leaves crowded on dwarf shoots .5—1.5 inches broad, orbicular, obtusely 3—5-lobed, lobes inciso-crenate, slightly hairy on both sides, basal nerves 3—7. Petiole .5—1 inch long, pubescent, sometimes glandular. Flowers .2-3 inch diameter, bisexual,

usually solitary, on short pubescent bracteate peduncles. Calyx adnate to the ovary, bristly-glandular; lobes spreading, greenish-white tinged with pink. Petals erect, white. Fruit a berry, .5 inch long, ovoid, glandular-hairy.

Occurs along the innermost dry ranges of hills bordering Tibet between 9,000 and 11,500 feet. Fairly common in open blue pine forest. Flowers: May-June. Fruit: August-September.

2. *Ribes orientale*, Desf. Vern. *Darbāg*, Bhotia. (but also used for other species of *Ribes*).—An erect deciduous shrub 4-5 feet high. Twigs reddish-brown, pubescent, glandular, sticky. Leaves .5—1.5 inches broad, orbicular or reniform, obscurely 3—5-lobed, lobes incisocrenate, clothed on both sides with minute pubescence mixed with scattered coarse sticky-glandular hairs, basal nerves 3—5. Petiole .2—1 inch long, stout, pubescent and glandular. Flowers .15 inch long, purplish-brown, polygamo-dioecious, in erect racemes .5—1.5 inches long. Pedicels .05—1.5 inch long, rather densely clothed with glandular and simple hairs. Berries .2-3 inch diameter, globose, orange-red, sparsely hairy and glandular.

Occurs along the innermost dry ranges of hills bordering Tibet between 9,500 and 11,500 feet. It is found growing on open stony ground. Flowers: April-June. Fruit: July-August.

3. *Ribes glaciale*, Wall. Vern. *Darbia*, G and A (but also used for other species of *Ribes*).—An erect deciduous shrub 6—12 feet high with stems up to 3 inches diameter. Bark dark grey or blackish, smooth on young stems, but becoming rough and peeling off in loose papery rolls on old stems. Twigs glabrous or with scattered hairs. Leaves 1.2-5 inches long and broad, usually 3—5-lobed, lobes usually acute or acuminate, sharply inciso-serrate, the lower often very small, base cordate truncate or rounded, glabrous or with scattered glandular hairs. Petiole .5—1.75 inches long with scattered glandular hairs, often tinged pink. Racemes erect, bracteate; males .8—2.75 inches long; females .2—1 inch long, 3—15-flowered. Bracts .1—2.5 inch long. Flowers pinkish- or greenish-brown, .2 inch diameter, glabrous or slightly pubescent. Calyx-lobes oblong with 4—6 nerves, often branched. Petals minute. Style bifid. Ovary more or less glandular. Berries globose or obovoid, .2 inch diameter, red, glabrous, on pedicels up to .1 inch long.

Occurs throughout the central and main Himalayan ranges between 8,000 and 12,000 feet. Common and often found growing on rocky or boulder-strewn ground, frequently associated with silver fir and *Betula utilis*. Occasionally found growing epiphytically near the base of some large trunk. Flowers: May-June.

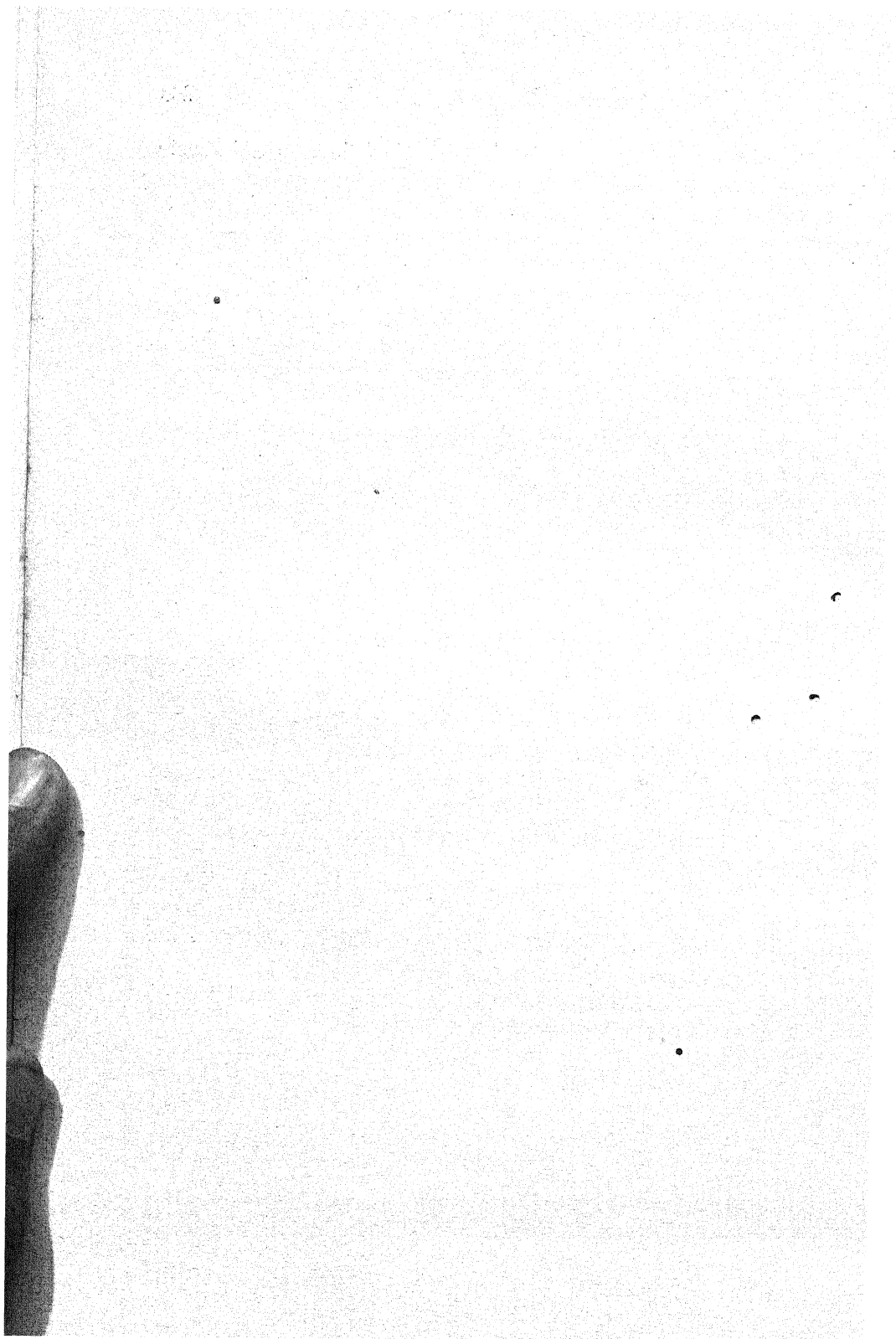
4. *Ribes acuminatum*, Wall.—An erect deciduous shrub 5-6 feet high with stems up to 1.5 inches diameter. Bark pale brown, rough, exfoliating in thin papery rolls. Twigs glabrous or with red glands.

Leaves 2·5—6 by 2·5—5 inches, usually 3—5-lobed, lobes usually acute or acuminate, sharply inciso-serrate, base usually cordate, glabrous pubescent or with scattered glands. Petiole 1-2·25 inches long, glabrous or pubescent, with scattered glands. Racemes erect, bracteate; males up to 4 inches long; females 5—1 inch long, 3—10-flowered. Flowers reddish-brown or purple, glabrescent or pubescent. Calyx-lobes ovate-ligulate, 3-nerved. Petals minute. Style bifid at the tip. Ovary glabrous or pubescent and glandular-hairy. Berries globose or ellipsoid, glabrous pubescent or with scattered glandular hairs, on pedicels up to 1·5 inch long.

This species has been collected by Duthie in the forest above Shinkola, by Strachey and Winterbottom near Dwali, and by Mr. R. N. Parker between Tithla and Galla, all in the Almora District, at elevations between 8,500 and 10,000 feet. It is sometimes found growing more or less epiphytically on tree trunks or on rocks. The distinctions between this plant and *R. glaciale*, Wall. are at present a little obscure. The character of the size of the leaf will be a good field character if found to be constant, but this admittedly requires confirmation. The neuration of the calyx-lobes also requires further study before it can be quoted as a definite distinction.

5. *Ribes rubrum*, Linn. Vern. *Kimkōlia*, NG. (but also used for other species of *Ribes*). Eng. The Red Currant.—A deciduous shrub 6—8 feet high with spreading erect or somewhat procumbent stems up to 1·5 inches diameter. Bark reddish-brown or blackish peeling off laterally in papery rolls, with prominent scattered lenticels. Blaze 2 inch, pink or white, with peculiar cellular structure due to fibrous bands running in two directions at right angles. Twigs glabrous or nearly so. Leaves 2·5—7 by 3—8·5 inches, cordate, 3—5-lobed, lobes usually acute or acuminate, inciso-serrate, 3—5-nerved at the base, clothed above with scattered stout pale hairs or nearly glabrous, hairy in the axils of the nerves beneath, dull green above and pale beneath. Petiole 1·5—6·5 inches long, broadened and often fimbriate at the base, pink. Flowers 3 inch long, greenish-yellow or brownish-pink, bisexual, in pubescent eglandular pendent racemes 1—7 inches long. Calyx glabrous. Berries 25 inch diameter, red or black.

Occurs throughout the central and inner ranges between 8,000 and 11,500 feet. Fairly common and somewhat gregarious in shady forest. Flowers: May-June. Fruit: October.



XXXVI.—RHIZOPHORACEÆ.

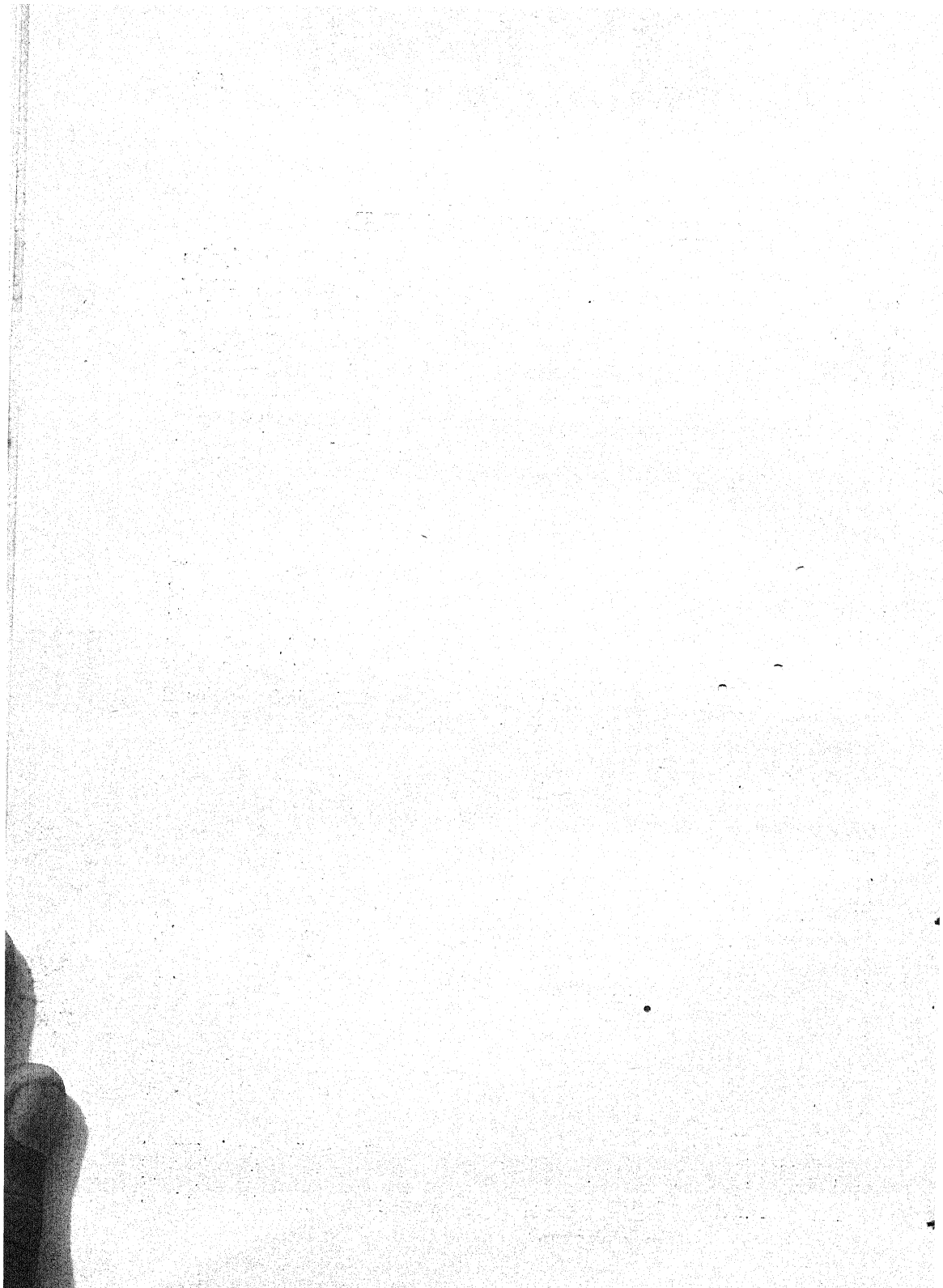
Trees or shrubs. Leaves opposite, entire or rarely toothed; stipules caducous. Flowers regular, usually hermaphrodite, axillary, rarely solitary. Calyx-tube more or less adnate to the ovary, rarely free; lobes 4—14, valvate, persistent. Petals as many as the calyx-lobes and shorter than them. Stamens usually twice as many as the petals, often in pairs opposite to them; anthers usually 2-celled. Ovary 2—5-celled or 1-celled by suppression of the septa; ovules usually 2 in each cell; style simple; stigma simple or lobed. Fruit usually leathery, indehiscent, 1-celled, 1-seeded. Embryo sometimes germinating while the fruit is on the tree.

CARALLIA, Roxb.

Trees or shrubs. Leaves entire or serrulate, glabrous. Flowers small, in 3-chotomous axillary branching cymes; bracteoles at base of calyx minute. Calyx-tube campanulate; lobes 5—8, valvate. Petals 5—8, inserted on a crenulate disk, clawed, entire or bifid, toothed or lacerate. Stamens twice the number of the petals and inserted with them on the disk. Ovary semi-inferior, usually 3—5-celled; ovules 2 in each cell; stigma 3—5-lobed. Fruit small, usually 1-celled, 1-seeded, indehiscent.

Carallia integerrima, DC.—A small evergreen glabrous tree up to 6 feet girth and 60 feet high, but usually smaller, with horizontally spreading branches. Bark pale brown, rough, thickly corky with shallow cracks or sometimes with deep corky ridges towards the base. Blaze .25—5 inch, rather hard, not fibrous, pale orange turning orange-brown on exposure. Twigs smooth, bright green, usually somewhat flattened, containing a large pith. Leaves 5—8 by 2-3 inches, broadly elliptic, obovate or oblong with a short blunt point, entire or sometimes serrulate on vigorous shoots, thick and rather fleshy, dark glossy green with conspicuous pale midrib above, pale and glossy beneath, with numerous indistinct lateral nerves. Petiole .2—5 inch long, stout. Flowers .2 inch diameter, white, in sessile clusters terminating the stout branches of trichotomous axillary cymes .5—1 inch long. Fruit .2-3 inch long, ovoid, crowned by the persistent calyx.

Occurs in the subhimalayan tract up to 2,000 feet. Scarce. It grows in swamps and along the banks of streams, and often sends up strong root-suckers. Aerial roots sometimes develop on the stem up to a height of about 10 feet from the ground. They are branched and grow to about 3 feet in length and 2 inches diameter, with corky bark. Flowers: February-March. Fruit: May.



XXXVII.—COMBRETACEÆ.

Trees and shrubs, often climbing. Leaves alternate subopposite or opposite, sometimes ternate, entire; stipules 0. Flowers hermaphrodite, rarely unisexual or polygamous, in spikes or racemes often paniced. Calyx-tube adnate to the ovary and produced above it, the limb 4-5-lobed, the lobes valvate. Petals 4-5 or 0, inserted on the calyx, alternate with the lobes. Stamens as many as, or twice as many as, the calyx-lobes, in 2 series. Ovary inferior, 1-celled, usually crowned with a lobed disk; ovules usually 2-3, sometimes more; style subulate; stigma simple. Fruit coriaceous or drupaceous, generally indehiscent, angular or winged, sometimes crowned by the persistent calyx.

I.—Trees.

- | | | | |
|--|-----|-----|------------------------|
| 1. Flowers in spikes. Fruit large | ... | ... | 1. <i>Terminalia</i> . |
| 2. Flowers in globose heads. Fruit small | ... | ... | 2. <i>Anogeissus</i> . |
| II.—Undershrubs or climbers | ... | ... | 3. <i>Combretum</i> . |

1. TERMINALIA, Linn.

Trees. Leaves alternate or subopposite, often with glands on the petiole or on the lower part of the midrib beneath. Flowers small, green or white, in solitary or paniced spikes; hermaphrodite or sometimes the upper flowers of the spike male, the lower female. Calyx-tube ovoid or cylindric, constricted above the ovary; limb campanulate with 5 valvate lobes. Petals 0. Stamens 10 in two series, the 5 upper alternate with the calyx-lobes, the 5 lower opposite them. Disk 5-lobed, villous. Ovules 2-3. Fruit drupaceous or dry, indehiscent, endocarp 4-5-angled, or pericarp produced into wings.

I.—Fruit drupaceous, not winged.

- | | | | |
|---|-----|-----|----------------------|
| 1. Leaves alternate, crowded towards the ends of the branches. Spikes simple | ... | ... | 1. <i>belerica</i> . |
| 2. Leaves mostly subopposite, scattered along the branches. Spikes mostly paniced | ... | ... | 2. <i>chebula</i> . |

II.—Fruit winged. Spikes mostly paniced

...	...	3. <i>tomentosa</i> .
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I have not included *T. Arjuna*, W. and A. as it has not to my knowledge yet been found wild or self-sown within our area. The leaves and fruit generally resemble those of *T. tomentosa*, but the former are glabrous. The pale grey or greenish smooth bark is also characteristic.

1. *Terminalia belerica*, Roxb. Vern. *Bāhera*, Gen.—A large deciduous tree up to 12 feet girth and 120 feet high. Bark dark bluish-grey with silvery or pale ashy patches, slightly rough with a few long vertical fissures exfoliating in irregular small scales. Blaze 7—9 inch,

soft, shortly fibrous, pale dirty yellow darkening on exposure, the juice turning black on the blade of a knife. Leaves 3—8 by 2—6 inches, alternate, crowded towards the ends of the branches, broadly elliptic or elliptic-obovate, puberulous when young, glabrous when mature, coriaceous, pale beneath, margins entire, subacute or acuminate, base narrowed and often unequal. Petiole 1—4 inches long, very rarely glandular. Flowers .5 inch across the stamens, pale greenish-yellow, in solitary axillary and extra-axillary interrupted spikes 3—6 inches long. Drupe 1—1.3 inches long, obovoid, grey-velvety containing a large rugose stone surrounded by rather dry greenish tissue.

Occurs throughout the subhimalayan tract and central and outer hill ranges up to 4,000 feet. Very common on open grazing grounds below the hills; also fairly common in *sal* forests. Flowers: April—June. Fruit: April—May.

2. *Terminalia chebula*, Retz. Vern. *Haira*, G. Harar, BD.—A small or medium-sized deciduous tree up to 7 feet girth and 75 feet high. Bark brown, rough, with shallow vertical cracks exfoliating in irregular woody strips and scales. Blaze .4—8 inch, soft, shortly fibrous, reddish-brown with a narrow inner layer yellow, the latter darkening on exposure, juice turning purple or black on the blade of a knife. Leaves 3—7 by 2.3—5 inches, subopposite or sometimes alternate, broadly elliptic-oblong, glabrous when mature, usually acute, base usually rounded often unequal. Petiole .5—1 inch long, often with 2 or more glands on the upper side near the top. Flowers .2 inch across the stamens, pale yellowish-white, all bisexual, in axillary and terminal often panicked spikes 1.5—5 inches long, pubescent or tomentose. Drupe 1—1.5 inches long, usually obovoid, yellowish-green, smooth, glabrous, with a large thick stone.

Occurs throughout the area up to 5,500 feet. Common in *sal* forests and in the dry miscellaneous forests of the hills, but in the latter case it is usually only a small tree. Flowers: April—June. Fruit: January—March.

3. *Terminalia tomentosa*, Wight and Arn. Vern. *Asin*, G. Sāj or Shāj, A. Sain, BD.—A medium-sized or large deciduous tree up to 12 feet girth and 100 feet high. Bark dark grey, brown or blackish, often tinged blue with fungus, rough, with rather deep irregular fissures. Blaze .5—1.2 inches, very fibrous, bright pink or reddish, but paler towards the interior, with a viscid juice which turns purple on the blade of a knife. Young parts with yellowish-brown pubescence. Leaves 5—9 by 2.5—4 inches, subopposite or the upper alternate, oblong or elliptic-ovate or obovate-oblong, glabrescent above, more or less tomentose beneath, coriaceous, entire or serrulate, obtuse or shortly pointed, base often cordate, midrib beneath often with 1-2 glands. Petiole .3—4 inch long. Flowers .25 inch across the stamens, dull yellow, bisexual, in erect axillary and terminal densely pubescent spikes 3—8

inches long, the terminal paniced. Fruit 1·5—2 inches long with 5 broad coriaceous wings, the wings over ½ inch broad with horizontal striations.

Occurs throughout the area up to 4,500 feet. Very common in the subhimalayan tract and in valleys in the outer hill ranges. A frequent companion of *sal*. I have measured a tree in the Ramnagar Division 16 feet girth and 105 feet high. Flowers: June—August. Fruit: February—April.

2. ANOGEISSUS, Wall.

Trees or shrubs. Leaves alternate or subopposite, petioled, entire. Flowers small, greenish, in dense globose heads on short axillary peduncles or in short cymes. Calyx-tube slender above the ovary; limb cup-shaped with 5 lobes. Petals 0. Stamens 10 in two series, adnate to the campanulate tube outside the crenate hairy disk. Ovules 2. Fruits packed in dense heads, compressed, 2-winged, ending in the persistent calyx-tube and sometimes limb, indehiscent.

Anogeissus latifolia, Wall. Vern. *Dhaura*, G. *Bākli*, BD.—A small or fairly large deciduous tree up to 8 feet girth and 110 feet high, the stems becoming more or less deeply fluted towards the base as they mature. Bark smooth, pale yellowish- or pinkish-brown spotted all over with paler greenish-yellow depressions from which the rounded woody scales have recently fallen. Blaze 3-4 inch, soft, not fibrous, pale pinkish-brown in the outer half, pale yellow in the inner half, slightly darkening on exposure. Leaves 2—4 by 1-2·5 inches, elliptic, acute or obtuse, entire, glabrous or nearly so, with 8—12 pairs of distinct secondary nerves. Petiole 3—5 inch long. Flower-heads 2½—3 inch diameter, on short axillary peduncles, one or more from the same leaf-axil, often branched. Fruit about 2 inch long excluding the beak and nearly as much across the wings, yellowish-brown, beak as long as or longer than the nucleus.

Occurs throughout the subhimalayan tract and central and outer hill ranges up to 4,000 feet. Very common and sometimes gregarious on southern aspects; a frequent associate also of *sal*. The foliage turns purple or purplish-red with the advent of the cold weather and remains so till it falls in February or March. Flowers: May-June. Fruit: February-March.

3. COMBRETUM, Linn.

Shrubs, usually straggling or climbing. Leaves entire, opposite, petioled, sometimes alternate or ternate. Flowers polygamo-dioecious, spicate, the spikes often paniced, sometimes with large white petaloid bracts. Calyx-tube constricted above the ovary; lobes 4-5. Petals as many as the calyx-lobes and inserted between them, sometimes 0. Stamens twice as many as the calyx-lobes, in two series. Ovules 2—5.

Fruit dry, usually indehiscent, with 4-5 ridges or wings, the wings chartaceous.

A climbing shrub. Flowers 5-merous ... 1. *decandrum*.

An erect undershrub. Flowers 4-merous ... 2. *nanum*.

1. *Combretum decandrum*, Roxb.—A large scrambling or twining evergreen climber. Young parts silky-pubescent. Leaves opposite, 3-5 by 1.5-2.5 inches, elliptic-oblong or elliptic, abruptly acuminate, glabrous or sometimes adpressed-hairy when mature, lateral nerves 6-8 pairs, arcuate, prominent beneath. Petioles .2-.4 inch long. Flowers .2 inch diameter, greenish-white, in dense rusty-villous spike-like racemes .5-1.5 inches long, the racemes arranged in large terminal panicles in the axils of leaf-like creamy-white bracts 1-2 inches long. Fruit 1-1.2 inches long, elliptic, with 5 tough papery brown wings .2-.25 inch broad.

There are no specimens at Dehra Dun from our area, nor have I seen any at Kew. Since however Duthie from his flora seems to have considered its occurrence undoubted, I have thought it best to include it. It is likely to occur in the subhimalayan tract or in the outer hills at low elevations. Flowers: November-December. Fruit: May.

2. *Combretum nanum*, Buch.-Ham.—An undershrub sending up annual woody erect shoots 1-2 feet high from a stout rootstock. Leaves opposite and alternate, 2-4 by 1.2-2.5 inches, broadly elliptic, ovate or obovate, entire, coriaceous, glabrous, with 3-5 pairs of arcuate lateral nerves. Petiole .1-.4 inch long. Flowers .25 inch diameter, white, fragrant, in simple or few-branched dense erect terminal racemes 1-4 inches long, often terminating short leafless shoots which have arisen direct from the rootstock. Stamens much exserted. Fruit 1-1.5 inches long, elliptic, pink or crimson, with 4 tough papery wings .3-.5 inch broad.

Occurs throughout the area up to 4,000 feet. Apparently not very common. It is sometimes found in dry *chir* forests, also on burnt areas such as fire lines in the submontane forests. Flowers: March-April. Fruit: May-June.

XXXVIII.—MYRTACEÆ.

Trees or shrubs, rarely herbs. Leaves entire, opposite or alternate, usually with an intramarginal nerve, and dotted with pellucid glands; stipules none or minute. Flowers regular, hermaphrodite or rarely polygamous, solitary or in cymes or corymbs. Calyx-tube adnate to the ovary and sometimes produced above it; limb 4-5-lobed. Petals as many as the lobes of the calyx, inserted on the margin of the disk or the mouth of the calyx-tube, imbricate, sometimes connate and falling as a calyptra. Stamens many, inserted within the petals in one or more rows. Ovary inferior or semi-inferior, 1- or more- but usually 2-celled, with many ovules. Fruit various, baccate drupaceous or capsular and opening by as many valves as there are cells.

- Leaves glabrous on both surfaces, often pellucid-dotted.
 Ovary 2-celled ... 1. *Eugenia*.
 Leaves pubescent beneath, not pellucid-dotted. Ovary
 many-celled ... 2. *Psidium*.

1. EUGENIA, Linn.

Trees or shrubs. Leaves opposite, usually glabrous. Flowers usually in 3-chorous cymes. Calyx-limb 4-5-lobed. Petals 4, rarely 5, sometimes calyptrate. Stamens numerous. Styles simple. Ovules many in each cell, but only 1-few developing.

I.—Secondary and intermediate nerves very fine, close, numerous and nearly straight.

1. Flowers .3—5 inch across the stamens, appearing March—May ... 1. *Jambolana*.
2. Flowers .8—1.2 inches across the stamens, appearing November-December ... 2. *frondosa*.

II.—Secondary nerves 8—13 pairs only, arched ... 3. *operculata*.

1. *Eugenia Jambolana*, Lamk. Vern. *Jāman*, Gen. *Phalenda*, generally used for cultivated varieties. A large evergreen glabrous tree up to 12 feet girth and 100 feet high. Bark pale brown, slightly rough on old stems with shallow cracks and depressions exfoliating in woody scales. Blade 1.5 inches, fibrous, red or pinkish-brown, the juice turning purplish-black on the blade of a knife. Leaves very variable, usually 3—6 by 1.5—2.5 inches, lanceolate elliptic-oblong or broadly ovate-elliptic, acute acuminate or subobtusely, coriaceous, smooth and shining above, with numerous close parallel fine secondary nerves uniting to form an intramarginal vein. Petiole .3—1 inch long, channelled. Flowers .3—5 inch across, whitish, fragrant, sessile,

arranged mostly in threes in trichotomous panicles 1·5—4 inches long which usually appear from the scars of fallen leaves, but sometimes in the leaf-axils. Calyx-tube 1·2 inch long, turbinate; limb truncate or obscurely 4-lobed. Petals united into a thin membranous calyptra. Fruit variable in size up to 1 inch long, ellipsoid or oblong, crowned with the truncate calyx-limb, black with pink juicy pulp.

Occurs throughout the area up to 4,000 feet. Common in most types of forest except the very dry areas, often abundant and gregarious in swampy or moist localities. Flowers: March—May. Fruit: June-July.

2. *Eugenia frondosa*, Wall. Vern. *Dūbka*, H.—A medium-sized or large tree attaining 8 feet girth and 60 feet high. Bark pale brown, silvery in patches, roughish and exfoliating in irregular woody scales when old. Blaze 6—9 inch, very fibrous, pinkish or reddish-brown, the juice turning blue on the blade of a knife. Leaves 4—7 by 1·5—2·75 inches, elliptic or elliptic-oblong, abruptly sub-caudate, base usually acute, coriaceous, dark glossy green above, pale beneath; secondary nerves very numerous, indistinct, uniting to form an intramarginal vein. Petiole 4—8 inch long, channelled. Flowers 8—1·2 inches across, white, faintly scented, arranged mostly in threes in trichotomous panicles 1—2·5 inches long, which are mostly terminal and axillary only rarely from leafless axils. Calyx-tube 25 inch long, turbinate; limb truncate or obscurely lobed. Petals united into a thin membranous calyptra. Fruit 5—7 inch long, oblong, purplish-black.

Occurs in the outermost hill ranges between 3,000 and 4,000 feet, but has not been recorded west of the Naini Tal cartroad, though found along this road. Easily confused with *E. Jambolana* when only seen in leaf. It grows on the banks of streams and does not appear to descend to the Bhabar. Flowers: November-December. Fruit: April-May.

3. *Eugenia operculata*, Roxb. Vern. *Paiman*, SG.—*Piāman* or *Rai-jāman*, BD.—A small or medium-sized tree up to 7 feet girth and 60 feet high. Bark pale brown, slightly rough, exfoliating in irregular woody plates. Blaze 8—1·1 inches, soft, very fibrous, but fibres short, pinkish-brown often pale, the juice turning purple on the blade of a knife. Twigs smooth, green, more or less compressed. Leaves 4·5—10 by 2·75—4·5 inches, broadly elliptic or obovate, apex rounded or with a short obtuse acumen, base rounded or cuneate, entire, glabrous, rather thick, with 8—13 pairs of arcuate secondary nerves, dull green above and below. Petiole 5—1·3 inches long. Flowers about 3 inch across, white, sessile, ternate, in trichotomous panicles 2—5 inches long, mostly from old leaf-scars. Petals united to form a calyptra. Berry 3·4 inch long, globose or ellipsoid with truncated concave tip.

Occurs throughout the subhimalayan tract and outermost hill ranges up to 4,000 feet. Fairly common in grassy glades in *sal* forest, also not uncommon in *sal* forest itself, especially the moister parts. The leaves have a pleasant aromatic smell when crushed, and turn bright shades of orange and red before falling from December to February. Flowers: April-May. Fruit: August-September.

2. *PSIDIUM*, *Linn.*

Trees or shrubs. Leaves opposite, entire, not dotted. Flowers large, white, on 1- or few-flowered axillary peduncles. Calyx urceolate or obovate, separating valvately into 4-5 lobes when in flower. Petals 4 or 5, free. Ovary many-celled, with numerous ovules in each cell. Fruit a globose ovoid or pyriform berry, usually crowned by the calyx-limb.

1. *Psidium Guyava*, *Linn.* Vern. *Amrūd*, Gen. Eng. Guava. —A large evergreen or subdeciduous shrub, sometimes a small tree up to 3 feet girth and 25 feet high. Stem irregularly fluted when old. Bark quite smooth, pale pinkish-brown or buff with grey patches, exfoliating in very thin woody plates. Blaze .1-.2 inch, cheesy, not fibrous, whitish or pinkish-brown usually tinged with chlorophyl outside, the juice turning purple on the blade of a knife. Leaves 4—6 inches long, oblong or elliptic-oblong, entire, glabrous above, pubescent beneath, pellucid-punctate, lateral nerves 10—20 pairs, prominent beneath, strongly curved near the edge and joined by intramarginal veins. Petioles .1—3 inch long. Flowers 1-1.5 inches diameter, white. Peduncles .5—1.5 inches long, axillary, 1—3-flowered. Calyx-tube adnate to the ovary and produced above it, the upper free portion entire, closed in bud at length bursting irregularly into lobes. Fruit a globose or pyriform berry 2 inches long or more.

Indigenous to Mexico, but cultivated throughout the area up to 5,500 feet, and sometimes found self-sown usually near habitations. The leaves usually turn reddish- or purplish-brown before falling. Flowers during the hot weather.



XXXIX.—LECYTHIDACEÆ.

Trees. Leaves alternate, entire or shortly toothed, usually crowded at the ends of the branchlets; stipules 0. Flowers large, solitary or in axillary or terminal racemes. Calyx-tube enclosing the ovary; lobes usually 4—6, rarely 2-3, valvate or imbricate. Petals 4—6, rarely more or 0. Stamens many in several series. Ovary 2—6- rarely more-celled, many-ovuled. Fruit a woody, fleshy or fibrous berry, with 1 or many seeds.

CAREYA, *Roxb.*

Trees or a small undershrub. Leaves crenate-serrate, crowded at the ends of the branches. Flowers large, showy, in racemes or interrupted spikes. Calyx-tube campanulate or funnel-shaped, hardly produced beyond the ovary; limb 4-lobed, the lobes imbricate. Petals 4, imbricate. Stamens very numerous, in several rows, slightly connate at the base. Ovary inferior, 4-5-celled, crowned by the annular disk. Fruit a large globose fibrous berry with numerous seeds.

Careya arborea, *Roxb.* Vern. *Kumbhi*, Gen.—A small or medium-sized deciduous tree up to 6 feet girth and 50 feet high. Bark brown or sometimes blackish, slightly rough with shallow longitudinal cracks, exfoliating in irregular pieces. Blaze .7—1.3 inches, very fibrous, dark often bright reddish-brown, the juice turning purple on the blade of a knife. Leaves approximate at the ends of the branches, 6—15 by 3—7 inches, broadly obovate or cbovate-oblong, apex rounded or shortly acuminate, crenate-denticulate, rather membranous, glabrous, dull green above, with 10—18 pairs of secondary nerves; the blade gradually narrowed at the base into a petiole 0—7 inch long. Flowers 3—5 inches diameter, sweet-scented, sessile, in stout terminal spikes, each flower subtended by a large elliptic central bract and two smaller linear lateral ones. Calyx .7—1.2 inches long, thick, with rounded lobes. Petals 2-3 inches long, oblong, fleshy, pale greenish tinged with pink, soon reflexed. Stamens conspicuous, .5—2.5 inches long, both the short innermost and the long outermost sterile, white except the basal half of the outermost rows which is bright red. Fruit 2.5—3 inches diameter, globose, green, glabrous, crowned with the calyx-tube.

Occurs in the subhimalayan tract and outermost hill ranges up to 2,500 feet. Common in *sal* forest. The leaves turn orange, red or purplish-brown before falling between January and April. Flowers: March-April. Fruit: July.



XL.—MELASTOMACEÆ.

Herbs or shrubs, sometimes climbing, rarely trees. Leaves opposite or rarely whorled, often ribbed from the base; stipules 0. Flowers regular, hermaphrodite. Disk sometimes present. Calyx-tube free or partly or entirely adherent to the ovary; limb 4-5-lobed, sometimes calyptrate. Petals as many as the calyx-lobes, inserted on the margin of the tube, imbricate. Stamens as many or often twice as many as the petals and inserted with them; connective often appendaged near the base. Ovary usually 4-5-celled, rarely 3, 6 or 1; ovules usually numerous. Fruit usually enclosed in the calyx-tube, capsular or baccate, dehiscent irregularly or by slits at the top of the cells, usually many-seeded.

OSBECKIA, *Linn.*

Herbs or shrubs, usually erect, branches usually 4-angled. Leaves opposite or sometimes ternate, entire. Flowers terminal, solitary capitate or paniced, often conspicuous. Calyx-tube much produced beyond the ovary, usually covered with simple or compound bristly hairs; lobes 4 or 5, alternating with as many appendages. Petals 4 or 5, usually broadly obovate. Stamens 8 or 10, equal or subequal, all similar. Ovary semi-inferior, 4-5-celled, bristly at the apex, ovules numerous. Fruit a capsule opening by pores at its apex.

Osbeckia stellata, *Wall.*—An erect deciduous shrub 3—6 feet high with rather softly woody and spreading stems up to 1 inch diameter. Bark smooth, pale brown. Twigs obscurely quadrangular, scabrid, rather densely clothed with adpressed rigid swollen hairs. Leaves opposite, 3—6 by 1-2·5 inches, lanceolate or elliptic, entire, acuminate, clothed above and on the nerves beneath with rather scattered short stout bristly hairs, membranous, with 5 strong basal nerves prominent beneath and running longitudinally down the blade. Petiole ½—1 inch long, bristly. Flowers 2—2·5 inches diameter, deep pink or mauve, in terminal and axillary spikes ½—1·5 inches long. Calyx 1 inch long, densely clothed with matted stellate bristles; tube ovoid. Stamens bright yellow, curved. Capsule ¼—¾ inch long, ovoid-oblong, included within the densely bristly yellowish-brown calyx-tube which is produced beyond the capsule.

Occurs throughout the hills between 4,000 and 6,500 feet. Fairly common in open forest and on steep rocky ground. Flowers: July—September. Fruit: April—June.



XLI.—LYTHRACEÆ.

Trees, shrubs or herbs. Leaves usually opposite, rarely alternate or verticillate, entire; stipules 0 or minute. Flowers hermaphrodite, usually regular, solitary or in axillary dichasia, sometimes paniculate. Calyx-tube persistent; lobes 3—6, valvate, often with accessory appendages alternating with them. Petals as many as the calyx-lobes, alternate with them, inserted on the mouth of the tube, sometimes 0, frequently clawed and wrinkled. Stamens as many as, or twice as many as, the calyx-lobes or very many, inserted on the calyx-tube. Ovary free, 1—6- rarely many-celled; ovules numerous on large axile, rarely parietal placentae. Fruit dehiscent or indehiscent, coriaceous or capsular, opening by valves or irregularly, usually many-seeded.

I.—Flowers perigynous. Stem unarmed.

- | | | | |
|---------------------------------|-----|-----|--------------------------|
| 1. Flowers zygomorphic. A shrub | ... | ... | 1. <i>Woodfordia</i> . |
| 2. Flowers regular. A tree | ... | ... | 2. <i>Lagerstræmia</i> . |

II.—Flowers epigynous. Stem often thorny ... 3. *Punica*.

1. WOODFORDIA, *Salisb.*

Shrubs, often arborescent. Leaves opposite, with black dots on the undersurface. Flowers in short axillary racemes, rarely solitary. Calyx-tube slightly curved, contracted above, oblique near the mouth; lobes 6, short, with short accessory appendages. Petals 6, very small. Stamens 12, usually much exerted, the alternate ones longer. Ovary sessile, 2-celled. Fruit a membranous capsule included in the calyx. Seeds numerous.

Woodfordia fruticosa, Kurz. Syn. *Woodfordia floribunda*, Salisb. Vern. *Dhauila*, Gen.—An evergreen or subdeciduous shrub with spreading stems usually 4—8 feet high, but rarely up to 20 feet high and 6 inches diameter. Old stems irregularly fluted with fairly smooth pale brown bark. Blaze 15—2 inch, pink. Twigs smooth, slender, often pendent. Leaves distichous, rarely in whorls of 3, 2—4 by 8—1.5 inches, lanceolate oblong-lanceolate or ovate-lanceolate, usually acuminate, base rounded or cordate, glabrous above when mature, pale and more or less pubescent on the nerves and with numerous black dots beneath, lateral nerves 6—12 pairs prominent beneath and joined by intramarginal veins, sessile or nearly so. Flowers 5—7 inch long, in dense axillary paniculate cymose clusters, the flowers usually opening

after the subtending leaves have fallen. Calyx large, tubular, red. Stamens much exserted; filaments red. Capsule globose, breaking up irregularly and enclosed within the calyx-tube.

Occurs throughout the area up to 6,500 feet. Abundant and often gregarious in dry secondary scrub forest, also common in open *chir* forests. The leaves usually turn red or purplish before falling. Flowers: February—April. Fruit: April-May.

2. *LAGERSTRÆMIA*, Linn.

Trees or shrubs. Leaves opposite or the uppermost alternate. Flowers often large and showy, in axillary racemes often forming terminal panicles. Calyx-tube campanulate; lobes 6, valvate. Petals 6, sometimes more, inserted on the top of the calyx-tube, clawed, the blade wrinkled. Stamens numerous, inserted near the base of the calyx-tube; filaments long. Ovary sessile, 3—6-celled; style long, curved. Fruit an ellipsoid loculicidal woody capsule, 3—6-valved.

***Lagerstrœmia parviflora*, Roxb.** Vern. *Dhaura* or *Dhauri*, BD. *Kath-dhaura*, SG. *Gobar-dhaura*. K and R.—A medium-sized deciduous tree up to 7 feet girth and 50 feet high. Bark rugged owing to long thin woody strips remaining half-detached, otherwise smooth, pale pinkish-brown, sometimes with blackish portions. Blaze .35—.5 inch, rather shortly fibrous, pale pinkish-brown, a narrow innermost layer white but rapidly turning purple on exposure, juice turning purple on the blade of a knife. Leaves distichous on horizontal shoots, arranged in 4 rows on erect shoots, opposite, 2.5—5 by 1-2 inches, narrowly elliptic, oblong or ovate-lanceolate, acute or acuminate, entire, coriaceous, glabrous or glabrescent above and finely pubescent beneath when young, usually glabrous on both sides when mature, pale glaucous beneath with 6—10 pairs of secondary nerves. Flowers .3—.5 inch diameter, white in lax, axillary and terminal, trichotomous copious leafy panicles. Cyme-branches and pedicels very slender. Calyx-tube cupular, smooth. Capsule .7—1 inch long, ellipsoid, polished, the base partially embraced by the enlarged and woody calyx-tube.

Occurs throughout the subhimalayan tract and outer hill ranges up to 3,000 feet. Very common in the dry miscellaneous forests of the Bhabar and often associated with *sal*. Flowers: April—June. Fruit: December-January.

3. *PUNICA*, Linn.

A large shrub or small tree, branches often spiny. Leaves opposite, subopposite or clustered, entire. Flowers axillary, solitary or several clustered together. Sepals 5—7, connate in a campanulate coriaceous calyx, below adnate to and above produced beyond the ovary. Petals 5—7, wrinkled. Stamens numerous, inserted round the mouth of the calyx. Carpels many, 2-seriate, connate in a many-celled inferior ovary; ovules numerous. Fruit a berry with a hard rind.

Punica Granatum, Linn. Vern. *Dārim*, HD. Eng.

Pomegranate.—A deciduous shrub or occasionally a small tree up to 3 feet girth and 20 feet high. Bark grey or pinkish-brown, smooth, exfoliating in thin woody plates and sometimes giving old stems a roughish appearance. Blaze .15—.25 inch, cheesy, not fibrous, pale yellow often tinged with chlorophyll outside. Branches and especially adventitious shoots often thorny. Leaves 1.2-1.5 inches long, oblong, obovate or elliptic-lanceolate, glabrous, minutely pellucid-punctate, shining above, bright green beneath, base narrowed into a very short petiole. Flowers 1.5—2 inches long and as much across, mostly solitary, sometimes 2—5 together, terminating short shoots. Calyx-tube thick and coriaceous with 5—7 lobes. Petals scarlet. Berry globose, 1.5—3 inches diameter, with coriaceous woody epicarp and crowned with the persistent calyx-lobes.

Indigenous in the Punjab Himalaya and cultivated throughout the area of this flora up to 5,500 feet. Though apparently not indigenous in our area, it has frequently run wild in the vicinity of habitations in the hills. Flowers: April—June. Fruit: July—September.



XLII.—SAMYDACEÆ.

Trees or shrubs. Leaves alternate, rarely opposite, simple, often with pellucid glands; stipules small or 0. Flowers regular, usually hermaphrodite, small, in axillary or subterminal fascicles racemes or panicles. Calyx coriaceous, persistent, tube sometimes adnate to the ovary; lobes 3—7, imbricate or valvate. Petals as many as the calyx-lobes or 0, perigynous. Stamens definite or indefinite, often alternating with staminodes, sometimes fascicled opposite the petals. Ovary 1-celled, superior or half-superior; ovules many, on 2—5 parietal placentae. Fruit a loculicidal 2—5-valved capsule.

CASEARIA, Jacq.

Shrubs or trees. Leaves alternate, with transparent glands, usually both as dots and lines; stipules small. Flowers small, greenish-yellow, in axillary fascicles (Indian species); pedicels jointed, surrounded by many scale-like bracteoles. Calyx inferior, deeply 4-5-lobed; lobes imbricate. Petals 0. Stamens normally twice as many as the calyx-lobes, alternating with as many staminodes tufted at their apex, the stamens and staminodes forming a ring attached below to the calyx-tube. Ovary free. Fruit a succulent, 3- or rarely 2-valved capsule, angled or ribbed when dry.

Leaves and twigs glabrous. Stipules .5 inch long ... 1. *graveolens*.

Leaves and twigs tomentose. Stipules minute ... 2. *tomentosa*.

1. *Casearia graveolens*, Dalz. Vern. Narwa, G. Narra, H. Pipri or Pimper, G and A.—A deciduous shrub 5—10 feet high or less frequently a small tree up to 3 feet girth and 30 feet high. Branches spreading horizontally and somewhat enlarged at their junction with the main stem. Bark pale brown or pale ashy, slightly rough, exfoliating in small irregular soft pieces. Blaze .3—5 inch, rather hard, not fibrous, uniformly pale orange or pale yellow finely streaked with pale orange. Young shoots glabrous. Leaves 4—8 by 2—4 inches, broadly elliptic, obtuse or shortly acuminate, entire or crenate-serrate, glabrous, with 8—12 pairs of lateral nerves. Petiole .2—5 inch long. Stipules about .5 inch long, caducous. Flowers .2 inch diameter, green, in dense clusters from the axils of fallen leaves. Pedicels short. Fruit .7—1 inch long, ellipsoid or ovoid, ribbed, yellow.

Occurs throughout the area up to 5,000 feet. Common in sal forest where it attains its largest dimensions; it also thrives on dry southern aspects with scattered low scrub forest in the hills. The leaves are usually tinged purple or turn a deep purplish-brown from January to March. Flowers: May-June. Fruit: June-July.

2. *Casearia tomentosa*, Roxb. Vern. *Chilla*, Gen.—A small evergreen or subdeciduous tree up to 6 feet girth and 50 feet high. Branches spreading horizontally. Bark dark brown, rather rough, with shallow reticulate cracks, exfoliating in small irregular woody scales. Blaze .35—.7 inch, rather hard, not fibrous, pink to purplish-red with a band of pale orange or yellow of varying width towards the interior. Twigs tomentose. Leaves 2.5—7 by 1.5—2.7 inches, oblong or the smaller ovate or elliptic, acute, more or less crenate-serrulate or subentire, tomentose especially on the nerves beneath, with 8—10 pairs of lateral nerves. Petiole .3—.5 inch long. Stipules minute, caducous. Flowers .2—.25 inch diameter, yellowish-green, in dense axillary clusters on the new shoots. Fruit .7—1.2 inches long, ellipsoid, green.

Occurs throughout the subhimalayan tract and central and outer hill ranges up to 3,000 feet. Common in *sal* as well as miscellaneous types of forest. Leaves sometimes turn red or orange before falling, and I believe invariably become spotted with patches of dead brown tissue about January before the leaves fall. Flowers: March—May. Fruit: April—May.

XLIH.—CUCURBITACEÆ.

Herbs, rarely shrubs, prostrate or climbing by means of tendrils spirally twisted. Leaves alternate, simple or lobed or palmately or pedately divided; stipules usually 0. Flowers regular, monoecious or dioecious, yellow or white, solitary paniculate or racemose. Calyx-tube usually adnate to the ovary; limb 5- rarely 3—6-lobed. Petals as many as the calyx-lobes, free or gamopetalous, sometimes lobed or fimbriate. Stamens inserted at various levels on the calyx-tube, normally 5 but usually connate in pairs so that only one remains free (in which case there appear to be two stamens with 2-celled anthers and 1 with a 1-celled anther); anthers free or connate; in male flowers staminodes often present. Ovary inferior, usually 1-celled, often spuriously 3-celled; style 1; stigmas 3—5; ovules usually many. Fruit a berry, entirely succulent or finally with a hard rind, rarely entirely dry, indehiscent or dehiscing by valves or by a circumscissile lid.

TRICHOSANTHES, *Linn.*

Herbaceous or woody climbers. Leaves entire or palmately lobed, rarely pinnate; tendrils 2—5-fid. Flowers white, dioecious, rarely monoecious, males usually in long racemes with a solitary female or male at the base from the same axil, or females separate. Calyx-tube long, cylindric, dilated above; lobes 5. Petals 5, connate at the base, margins long-fimbriate. Stamens 3; anthers usually connate; in male flowers staminodes 0. Ovary with 3 parietal placentae; ovules many; stigmas 3, entire or bifid. Fruit smooth, indehiscent. Seeds many, compressed.

Trichosanthes palmata, *Roxb.* Vern. *Indarain*, SG. and RK. *Ilāru*, NG.—A large deciduous climber with stems up to 4 inches diameter and 50 feet high, often forming dense masses of drooping foliage, climbing by means of tendrils. Bark pale grey or pale yellowish-brown, with many longitudinal rows of much-raised darker circular lenticels, otherwise smooth. Blaze 3-4 inch, soft, cheesy, pale yellowish. Tendrils with 1—3 branches arising from the end of a stalk 1-2 inches long. Leaves 4—7 inches broad and as long or slightly longer, suborbicular or broadly ovate, deeply cordate, 3—7- usually 5-lobed or rarely undivided, the lobes acute or acuminate, denticulate the nerves excurrent, upper surface smooth and bright green with small pits when fresh but very scabrous with small round discs (cystoliths) when dry

lower surface paler with cystoliths on the nerves when dry, pubescent on the nerves, otherwise glabrous on both surfaces, base 3—5-nerved. Petiole 1—3 inches long, stout, grooved. Flowers 1·5—2·5 inches diameter, white, dioecious. Male peduncles usually paired, axillary, one bearing a solitary flower, the other racemed 3-4 inches long. Female flowers solitary, axillary, on a short peduncle. Bracts foliaceous ·5—1·5 inches long, broadly obovate. Calyx-tube 1-2 inches long, the lobes irregularly toothed. Fruit 1·5—2·5 inches diameter, ellipsoid, smooth, first yellow, then red streaked with yellow and finally a uniform deep red, with a thick tough rind. Seeds reddish-brown surrounded by copious greyish-green pulp.

Occurs throughout the area up to 6,000 feet. There are no specimens at Dehra Dun from the submontane tract, though there is little doubt it occurs there also. It is fairly common in moist ravines and bordering streams in the hills. Flowers : June-July. Fruit : October-November.

XLIV.—DATISCEÆ.

Trees or herbs. Leaves simple or pinnate, alternate; stipules 0. Flowers small, regular, dioecious or rarely bisexual, in fascicles racemes or panicles. Calyx-tube in male short; in female adnate to the ovary; lobes 3—9. Petals 0. Stamens 4 or more, usually opposite the calyx-lobes. Ovary 1-celled, open or closed at the apex; placentae parietal; ovules numerous; styles as many as the placentae and alternate with them, simple or 2-partite. Fruit a coriaceous or membranous capsule, dehiscing at the apex between the styles. Seeds numerous, minute.

DATISCA, *Linn.*

Herbs or shrubs. Leaves 3-partite or unequally pinnate, the uppermost undivided. Flowers dioecious, axillary, clustered. Male: calyx-tube very short; lobes 3—9; stamens 9—25; no rudimentary ovary. Female: calyx-tube ovoid; styles 3, each divided nearly to the base into 2 linear stigmas. Capsule oblong, more or less 3-angled.

***Datisca cannabina*, Linn.**—A shrub with annual erect stems up to 10 feet high and 1 inch diameter and a stout woody perennial rootstock. Stems with a large succulent pith, but almost woody at the base, smooth, green, with lenticels more or less arranged in longitudinal rows. Side branches numerous in the upper portion of the stem and usually 6—18 inches long. Leaves imparipinnate, up to 15 inches long. Leaflets 3—11, the lateral opposite, the distal pair sessile the remainder usually shortly petiolulate; the terminal one 4—6 by .5—1.75 inches, larger than the others; all narrowly lanceolate, caudate-acuminate, sharply serrate except the tail which is usually entire, glabrous and dark glossy green above, glabrescent paler and glossy beneath. Flowers small, green, single or clustered in the axils of reduced 1-foliolate usually linear-lanceolate leaves, along the terminal portion of the main stem and of its upper branches. Male flowers on slender pedicels .1—2 inch long; calyx deeply 5-lobed; anthers conspicuous, .1—1.5 inch long. Female flowers shortly pedicellate; calyx-tube about .1 inch long, campanulate with 3 short spreading lobes. Capsule .2—3 inch long, crowned with the calyx-lobes.

Occurs in the hills between 3,000 and 5,000 feet. Not very common, usually in damp localities on open ground, somewhat gregarious. Flowers: August-September. Fruit: October-November.



XLV.—CACTACEÆ.

Herbs shrubs or trees with usually succulent stems; branches often thickened, striated or angled. Leaves usually represented by tufts of spines or by prickles or small tubercles; stipules 0. Flowers regular, hermaphrodite, solitary. Calyx-tube adnate to the ovary; lobes 3-many, small, imbricate. Petals many, free or shortly united at the base, imbricate. Stamens very many, free or adnate to the base of the petals. Ovary 1-celled; ovules numerous; style simple; stigma 2-many-rayed. Fruit a succulent berry with pulpy placentæ.

OPUNTIA, Mill. (*The Prickly Pears.*)

Shrubs; branches jointed, the joints fleshy, flattened. Leaves small, cylindric or subulate, caducous leaving axillary scars or "areoles" from which arise very numerous fine barbed bristles and often one or more larger prickles or spines. Flowers showy, yellow orange or red, from the marginal or apical areoles. Outer calyx-lobes adnate to the ovary. Outer petals sepaloid, inner petaloid. Ovary of many connate carpels; stigmas many. Fruit pyriform, bearing areoles.

Opuntia monacantha, Haw.—A succulent jointed shrub 3—8 feet high, with the internode-like portions of the axis between the articulations much compressed obovate to oblanceolate and bright green. Leaves .25 inch long, brown, caducous. Areoles bearing 1—3 straight spines, usually 1-2.5 inches long and one often larger than the others, with a tuft of silky hairs about .2 inch long at the base. Flowers 2-2.5 inches long and about 3 inches across, yellow. Corolla spreading, rotate, the outer segments short ovate-acute, the inner spatulate acute denticulate. Stamens yellow, short. Pistil longer than the stamens. Fruit pyriform, truncate and deeply depressed at the apex, bearing tufts of glochidia on the outside.

This species has been collected in the Naini Tal Division and is I believe the species which occurs fairly commonly in cultivation or run wild throughout the hills up to 5,000 feet. *Opuntia Dillenii*, Haw. is recorded from Almora by Strachey and Winterbottom, but the identification in this case may have been incorrect. The two are very similar. According to Parker the joints of *Dillenii* are dull bluish or greyish-green. Haines mentions that in *monacantha* the spines are deciduous except one large one (rarely 2-3) on each areole whilst in *Dillenii* several large spines usually remain on each areole, the largest of which is sometimes curved. Moreover in *Dillenii* the number of spines in each areole may ultimately vary up to 6 whilst in *monacantha* they do not apparently exceed 3. These *Opuntias* are indigenous to America.



XLVI.—ARALIACEÆ.

Trees and shrubs, sometimes climbing, rarely herbs, glabrous or stellately pubescent, frequently prickly. Leaves alternate, rarely opposite, simple or compound; stipules adnate to the petiole, rarely 0. Flowers regular, hermaphrodite or polygamous in umbels, umbels usually racemed or paniced. Calyx-tube adnate to the ovary; limb truncate or with small teeth. Petals usually 5, rarely more, valvate or sub-imbricate, sometimes calyptrate. Stamens as many as and alternate with the petals, inserted round an epigynous disk. Ovary inferior 2-many-celled; ovules solitary in each cell; styles as many as the cells, distinct or united. Fruit coriaceous or drupaceous.

- I.—Leaves simple, lobed or not ... 1. *Hedera*.
- II.—Leaves tripinnate, very large ... 2. *Heteropanax*.
- III.—Leaves digitate.
 - 1. Stems usually armed with prickles.
 - (a) Leaflets glabrous or with simple hairs ... 3. *Aralia*.
 - (b) Leaflets stellately hairy beneath ... 4. *Brassaiopsis*.
 - 2. Stems unarmed.
 - (a) A large climber or, if erect, the leaflets stellately hairy beneath ... 5. *Heptapleurum*.
 - (b) Erect. Leaflets glabrous ... 6. *Macropanax*.
- IV.—Leaves pinnate. Leaflets 5 ... 7. *Pentapanax*.

1. *HEDERA*, Linn.

Climbing shrubs or small trees. Leaves simple or lobed, glabrous, exstipulate. Flowers polygamous in paniced umbels. Pedicels not or very obscurely jointed. Calyx-margin 5-toothed or subentire. Petals 5, valvate. Stamens 5. Ovary 5-celled; styles connate. Fruit globose.

***Hedera Helix*, Linn.** Eng. Ivy.—An evergreen climber with stems up to 3—5 inches diameter and 40 feet high, climbing by means of adventitious roots which are often so numerous towards the base as to completely conceal the stem. Bark fairly smooth, pale brown, lenticellate. Blaze 15—25 inch, very shortly fibrous, pale yellow. Leaves alternate, very variable; on flowering shoots 2—4 inches long, usually not lobed, very variable in breadth, base usually narrowed; on sterile shoots usually with 1—5 pairs of lobes and usually cordate bases; all coriaceous, glabrous. Petioles slender, 5—5 inches long. Flowers 25—4 inch diameter, polygamous, green, in globose pedunculate umbels; umbels terminal, solitary or 2—6 in corymbs; peduncles and pedicels clothed with minute stellate hairs. Pedicels 2—4 inch long. Petals

triangular with a raised ridge down the centre on the inside, soon recurved. Berry .3 inch diameter, globose, greenish-yellow or orange-yellow, with fleshy exocarp.

Occurs throughout the hills between 3,000 and 9,000 feet. Very common in shady forest. Flowers: September-October. Fruit: March-May.

2. HETEROPANAX, *Seem.*

An unarmed tree. Leaves pinnately decompose. Bracts small, persistent; pedicels not jointed under the flower. Flowers polygamous, calyx-margin nearly entire. Petals and stamens 5. Ovary 2-celled; styles 2, distinct. Fruit 2-seeded.

Heteropanax fragrans, *Seem.*—A small erect evergreen tree up to 2 feet girth. Leaves tripinnate, 3-4 feet long and 2-3 feet across. Leaflets 3-6 by 1.5-3 inches, elliptic or elliptic-ovate, shortly acuminate, base rounded sometimes oblique, entire, glabrous. Petiolules 0-4 inch long. Flowers .15-.25 inch diameter, yellow, fragrant, in dense globose umbels racemed on the branches of an erect panicle 18-24 inches long which is clothed with a deciduous rusty stellate scurf or tomentum. Pedicels up to .1 inch long, lengthening in fruit. Fruit .3-.4 inch diameter, strongly compressed at right angles to the septum.

Occurs throughout the subhimalayan tract and outer hill ranges up to 4,000 feet. Not common. Flowers: November-December. Fruit: February.

3. ARALIA, *Linn.*

Herbs shrubs or small trees, often prickly. Leaves alternate or whorled, digitate pinnate or compound-pinnate; stipules small. Flowers often polygamo-dioecious; pedicels often jointed close under the flower. Calyx truncate or 5-lobed. Petals and stamens 5. Ovary 2-5-celled; styles 2-5, free or shortly connate at the base. Fruit 4-5-celled and angled or subglobose and 2-3-celled.

Aralia cissifolia, *Griff.*—An erect or suberect deciduous shrub 2-6 feet high and stem up to 1 inch diameter. Bark pale brown, fairly smooth. Stems often armed, especially in the lower portion, with scattered weak prickles about .1 inch long, often forming a semicircular ring below an arrested side branch. Leaves alternate, digitate, often fascicled on arrested side shoots. Petiole 2.5-7 inches long, smooth, terete, base sheathing. Leaflets 3-5, the terminal slightly the largest 2.5-6 by .7-2.25 inches, elliptic-lanceolate or oblong-lanceolate, acuminate, base acute, finely and closely biserrate, the serratures apiculate or acuminate, glabrous or with short scattered stout hairs on both surfaces, membranous, pale dull green above, somewhat

glaucous beneath. Petiolules 0—1 inch long. Flowers .2—3 inch diameter, greenish-yellow, 4-and 5-merous, in solitary axillary pedunculate many-flowered umbels. Peduncles 1-2 inches long. Pedicels .15—.25 inch long, glabrous or pubescent. Berry .25 inch diameter, globose, glabrous.

Occurs throughout the central and inner ranges between 8,000 and 10,000 feet. Fairly common and somewhat gregarious in shady forest usually on north aspects. The semicircular ring of prickles when present originates at the base of the partly sheathing petiole and persists after the leaf has fallen. The crushed leaves have a foetid smell. Flowers: May-June. Fruit: July-August.

4. BRASSAIOPSIS, *Dcne. and Planch.*

Large shrubs or trees, glabrous or tomentose, armed or not. Leaves digitate palmate or angled, stipulate. Umbels in compound panicles; bracts often persistent; pedicels rising from a dense cluster of persistent bracteoles, not jointed under the flower. Flowers often polygamous. Calyx 5-toothed. Petals and stamens 5. Ovary 2-celled; styles 2, united. Fruit 1-2-seeded.

***Brassaiopsis aculeata*, Seem.**—A shrub or small tree up to 3 feet girth and 15 feet high. Stems and branches armed with stout sharp prickles up to .35 inch long. Young shoots clothed with rusty-brown tomentum. Bark fairly smooth, pale brown. Blaze .3—.35 inch, soft, pale yellowish. Leaves 1-2.5 feet long, alternate, digitate, approximate at the ends of the rather stout branches. Petiole 4—18 inches long, terete, the base dilated and stem-clasping. Leaflets 5—9, the central 6—12 by 1.5—3 inches exceeding the lateral, oblanceolate, acuminate, base acute and usually oblique in the outermost pair, serrulate, densely clothed on both surfaces with yellow stellate hairs when young, glabrous above when mature, thin. Petiolules .1—.5 inch long. Flowers .25—.3 inch diameter, pale yellowish-green, in many-flowered globose umbels. Umbels solitary and terminal or racemed on the somewhat deflexed branches of a stout erect panicle 6—12 inches long. Panicle-branches .5—3 inches long. Bracts at the base of the branches .15—.25 inch long, ovate, acuminate, tomentose, persistent. Pedicels .2—.5 inch long, scurfy-hairy, springing from a dense cluster of hairy persistent bracteoles .05 inch long. Berry .25 inch diameter, globose.

Occurs throughout the hills between 2,000 and 6,000 feet. Rather scarce. Usually in shady and moist ravines in forest. Flowers: January—March. Fruit: May-June.

5. HEPTAPLEURUM, *Gartn.*

Trees or large shrubs, sometimes scandent, without prickles. Leaves digitate, rarely uni-foliolate or twice digitate. Umbels paniced or in branched racemes, bracts woolly, pedicels not jointed under the

flower. Flowers 5—10—usually 5-6-merous (including the carpels). Style very short and clavate or scarcely developed. Fruit 5-6-angled.

Erect. Leaflets with secondary nerves deeply impressed above, stellately hairy beneath ... 1. *impressum*.

A climber. Leaflets with secondary nerves not deeply impressed above, glabrous beneath ... 2. *venulosum*.

In addition, *H. elatum*, C. B. Clarke is recorded by Strachey and Winterbottom from Naini Tal. I have however seen no specimens from our area in either the Dehra Dun or Kew herbaria and I have therefore not described it. It is a small tree with large digitate leaves of 4—7 oblong-lanceolate leaflets which are glabrous above and glabrous or nearly so beneath. The nerves of the leaflets are not deeply impressed above, and this fact together with the glabrous or glabrescent under leaf-surface should serve in the field to distinguish it at once from *H. impressum*.

1. **Heptapleurum impressum**, C. B. Clarke.—A large evergreen shrub or small tree, the stem up to 4·5 feet girth near the ground but usually branched low down, up to 30 feet high. Bark fairly smooth, pale brown. Blaze 3—3·5 inch, white. Leaves digitate, 1·2·5 feet long, approximate at the ends of the stout branches. Petiole 5—22 inches long, terete. Leaflets 6—11, 4—10 by 7·5—2 inches, oblanceolate or sometimes narrowly oblong, shortly acuminate, base acute, coriaceous, entire or sometimes obscurely serrate in the upper half, clothed on both surfaces with rusty-yellow stellate pubescence when young, glabrous and dull dark green above with much impressed secondary nerves when mature. Flowers in globose umbels terminating the branches of an erect terminal densely stellate-hairy panicle 6—8 inches long. Pedicels 1—2 inch long, lengthening in fruit. Berry 2 inch diameter, subglobose, glabrous, crowned with the persistent style.

Occurs throughout the central and inner ranges between 7,000 and 10,000 feet. Rather scarce. Usually found in moist shady situations, sometimes associated with *Quercus semecarpifolia*. The leaflets on young plants or on adventitious shoots are often deeply cut or lobed. Flowers: September. Fruit: December-January.

2. **Heptapleurum venulosum**, Seem. Vern. *Kur-simal*, Gen.—An evergreen climber or epiphytic shrub with stems up to 4 inches diameter and 30 feet high, climbing by means of stout adventitious roots. Bark pale ashy-brown or silvery, smooth, with conspicuous scattered lenticels. Blaze 4·5 inch, somewhat fibrous towards the interior, pale yellow or whitish, sometimes mottled with pale orange harder tissue in the outer half, darkening on exposure, with a peculiar aromatic smell. Twigs stout, smooth, green with pale brown lenticels, the leaf-scars appearing as horizontal lines. Leaves alternate, digitate. Petiole 6—12 inches long, terete, dilated and clasping at the base. Leaflets 3—8, 3—6 by 1·5—3 inches, the middle one largest, elliptic-oblong, acuminate, entire, glabrous, coriaceous, shining above. Petioles 5—2 inches long, jointed to the blade. Flowers 3 inch diameter,

pink, polygamous, in small globose umbels, racemed on the branches of a terminal panicle, the branches 5—8 inches long and purple. Peduncles .5 inch long. Pedicels .1—3 inch long. Berry .3-.4 inch diameter, globose, yellow.

Occurs throughout the area between 1,000 and 6,000 feet. Common, usually in moist places, often climbing over precipitous rocks in shady ravines but also frequent on trees. Flowers: February-March. Fruit: April-May.

6. MACROPANAX, *Miq.*

Trees or shrubs, thorny or unarmed. Leaves digitate. Flowers polygamous, umbelled, or rarely in heads, forming large panicles. Pedicels jointed at the apex. Calyx-teeth 5, distinct. Petals 5, valvate. Stamens 5. Disk thick, produced into the style-column. Ovary 2-celled; styles united. Fruit globose or ovoid.

Macropanax oreophilum, *Miq.*—A large shrub or small tree. Leaves alternate, 1-2 feet long. Petioles 4—12 inches long, terete, base dilated and stem-clasping. Leaflets 3—7, 4—9 by 1.2—2.5 inches, narrowly oblong or elliptic-oblong, acuminate, base rounded or cuneate often unequal, margin sinuate or crenulate with small apiculate teeth, glabrous, lateral nerves arcuate. Petiolules .3—2 inches long, those of the central leaflets much longer than the side ones. Flowers .15 inch diameter, in many-flowered globose umbels. Umbels racemed on the spreading branches of an erect terminal panicle 10—20 inches long, densely clothed with scurfy tomentum. Panicle-branches 2—8 inches long. Bracts small, deciduous. Pedicels .05—1.5 inch long lengthening in fruit. Berry .2 inch diameter, ovoid, ribbed.

Strachey and Winterbottom have recorded this species from Naini Tal and Mr. W. J. Lambert has collected it at Panwanoula in East Almora. Both records are from 6,000 feet. Rare. Flowers: August-September. Fruit: December-January.

7. PENTAPANAX, *Seem.*

Trees or large climbing shrubs, often epiphytic. Leaves alternate, simply pinnate or digitate, glabrous. Flowers hermaphrodite or polygamous in compound racemes or panicles of umbels; pedicels jointed under the flowers. •Calyx 5-lobed. Petals and stamens 5. Ovary 4-5-celled; styles 4-5, more or less connate. Fruit 4-5-celled with as many angles or ribs.

Epiphytic. Leaflets entire	...	...	...	1. <i>parasiticum</i>
Not epiphytic. Leaflets serrate	...	...	...	2. <i>Leschenaultii</i> .

1. **Pentapanax parasiticum**, *Seem.*—A scandent and epiphytic deciduous shrub with spreading or drooping branches 4—8 feet long and up to 2 inches diameter, sending down stout aerial roots which form contact with the ground and often resemble stems. Bark pale

or silvery brown, fairly smooth. Blaze 1-2 inch, very fibrous, white, the juice turning orange on exposure. Leaves 4-10 inches long, imparipinnate; petiole slender, not dilated at the base, rachis jointed at the insertion of the leaflets. Leaflets 5, 2-4 by 1-2 inches, ovate or ovate-lanceolate, entire, acuminate, base rounded often unequal, subcoriaceous, glabrous beneath, somewhat glossy above and glaucous beneath. Flowers .25 inch diameter, pale green, 5-or 6-merous, polygamous, in globose pedunculate umbels which are terminal solitary or 2-4 in a small panicle. Peduncle 1-3 inches long. Pedicels .3-.5 inch long, slender. Fruit small, subglobose.

Occurs throughout the hills between 5,500 and 8,000 feet, and in all the cases which I have observed it was growing on oak except once when it was found growing on the ground. Rather scarce. Flowers: October.

2. *Pentapanax Leschenaultii*, Seem.—A deciduous shrub 4-10 feet high with stems up to 2.5 inches diameter. Bark roughish, exfoliating in papery pieces. Twigs with a large pith. Leaves 8-12 inches long, alternate, imparipinnate. Leaflets 5, 3.5-5.5 by 1.5-2.5 inches, elliptic-oblong or elliptic, rather abruptly acuminate, base rounded or subcordate often unequal, cuspidate-serrulate, glabrous and dull green above, hairy along the nerves beneath when young especially along the midrib. Petiolules of lateral leaflets 0-.25 inch long. Inflorescence a terminal panicle, the primary branches sub-fascicular, 2-3 inches long and terminating in 3-8 umbel-bearing rays about .5-1 inch long. Umbels dense, globose. Pedicels .3-.5 inch long. The branches of the inflorescence clothed with short purplish pubescence. Fruit subglobose, .15 inch diameter, strongly ribbed.

Occurs throughout the central and inner ranges between 8,000 and 10,500 feet. Sometimes wedged into crevices in rocks, usually in forest. Scarce. Flowers: July. Fruit: August-September. The plant here described is variety *umbellatum* which differs from the type in the fruit being strongly ribbed.

XLVII.—CORNACEÆ.

Shrubs or trees. Leaves opposite or alternate, entire or sometimes angularly lobed or serrate; stipules 0. Flowers regular, bisexual or unisexual, in cymes panicles or heads. Calyx-tube adnate to the ovary; limb 0 or truncate or 4—10-toothed, persistent. Petals 0 or 4-5, rarely many, imbricate or valvate. Stamens inserted with the petals at the base of an epigynous disk, usually as many as, rarely 2—4 times as many as the petals. Ovary inferior, 1—4-celled; ovules usually solitary; style simple. Fruit usually succulent, stone 1—4-celled or less commonly with 2 pyrenes.

I.—Flowers fascicled, in cymes or in heads.

- | | | | | |
|---|-----|-----|-----|----------------------|
| 1. Inflorescence axial. Petals anthers and style long | ... | ... | ... | 1. <i>Alangium</i> . |
| 2. Inflorescence terminal. Petals anthers and style short | ... | ... | ... | 2. <i>Cornus</i> . |

II.—Flowers in large terminal panicles ... 3. *Toricellia*.

1. ALANGIUM, *Lamk.*

Trees or shrubs, sometimes thorny. Leaves alternate. Flowers white or cream-coloured, hermaphrodite, in axillary fascicles or cymes. Calyx-limb truncate or 4—10-toothed. Petals 4—10, linear, valvate, thickened, recurved in flower. Stamens as many as the petals and alternate with them, or 2—4 times more. Ovary 1-2-celled, surmounted by a disk enclosing the elongate style; stigma capitate. Fruit a 1-2-seeded berry, crowned by the calyx-lobes and disk.

Leaves oblong, 1-2 inches broad. Flowers fascicled ... 1. *Lamarckii*.

Leaves ovate often lobed, 3—6 inches broad. Flowers in cymes ... 2. *begonifolium*.

1. *Alangium Lamarckii*, *Thwaites*. Vern. *Kuilu*, R.—A small subdeciduous tree up to 3·5 feet girth and 30 feet high, the short side branches often terminating in stout spines. Bark pale brown, roughish, with shallow cracks, exfoliating in softly fibrous or subcorky scales. Blaze 4—7 inch, slightly fibrous, pale yellow, often stippled with orange. Twigs whitish. Leaves simple, rather variable in size, usually 4—7 by 1—2·5 inches, oblong or oblong-lanceolate, gradually narrowed at the apex to a blunt point, base usually rounded and sometimes unequal, pubescent when young, glabrous or glabrescent when mature with glandpits or tufts of hair beneath in the nerve axils, secondary nerves 5—8 pairs ascending, tertiaries more or less parallel and transverse. Petiole 2—5 inch long, tomentose. Flowers white,

fragrant, solitary or fascicled, axillary or from the axils of fallen leaves. Petals 5—10, .5—·9 inch long, linear, recurved or revolute after expanding. Stamens numerous about as long as the petals, very villous below. Anthers .2—·3 inch long. Fruit .5—·7 inch long, ellipsoid, smooth, black, crowned with the calyx and containing a large stone surrounded by succulent pulp.

Occurs in dry miscellaneous forests of the Bhabar and is generally rather scarce though abundant round Tanakpur, and in parts of the Kalagarh Division. Flowers: March—May. Fruit: June-July.

2. *Alangium begonifolium*, Baill. Syn. *Marlea begoniæfolia*, Roxb.—A small deciduous tree. Bark pale grey or brown, smooth. Blaze .3—·35 inch, pale yellow closely mottled with orange. Leaves usually 3—6 by 2·5—6 inches, sometimes larger, broadly ovate, acuminate, entire, angular or lobed or rarely without lobes, the lobes or angles acuminate, pubescent on both surfaces with minute hairs when young, becoming glabrous or nearly so above and with tufts of hair in the nerve-axils below when mature, base usually truncate or cordate often very oblique, 5—7-nerved. Petioles 1-2 inches long. Flowers white, in dichotomous axillary cymes 1-2 inches long. Petals 6—8, ligulate, .4—·5 inch long. Stamens 6—8, about as long as the petals. Filaments villous. Anthers .3 inch long. Fruit .3—·4 inch long, ovoid or ellipsoid, glabrous, dark purple, succulent, containing a large stone.

Occurs throughout the hills between 3,000 and 6,000 feet. Not common. Usually in moist ravines. Flowers: May-June. Fruit: September-October.

2. CORNUS, Linn.

Trees or shrubs. Leaves opposite or alternate, entire. Flowers small, usually bisexual, in branched cymes or involucrate heads. Calyx-tube campanulate or urceolate; limb 4-toothed. Petals 4, valvate. Stamens 4. Disk thick or inconspicuous. Ovary 2- rarely 3-) celled. Fruit drupaceous; stone bony, 2-celled, 2-seeded.

I.—Leaves opposite.

A. Flowers in branched cymes.

- | | |
|---|-----------------------------|
| 1. Leaves ovate, 2—4 inches broad ... | ... 1. <i>macrophylla</i> . |
| 2. Leaves narrowly oblong, 1-1·5 inches broad ... | 2. <i>oblonga</i> . |

B. Flowers in hemispheric heads surrounded by 4 large yellow petaloid bracts ...

... 3. *capitata*.

II.—Leaves alternate. Flowers in branched cymes ...

... 4. *controversa*.

1. *Cornus macrophylla*, Wall. Vern. *Khāgsa*, G. *Kais*, A.—A medium-sized deciduous tree up to 7 feet girth and 100 feet high. Bark reddish or pinkish-brown, roughish, exfoliating in loose strips and scales, divided up on very old stems into small polygonal plates about .5 inch across. Blaze .25—·35 inch, soft, cheesy, pink. Leaves opposite and

distichous, 3—6 by 2—4 inches, ovate, acuminate, with short adpressed hairs on both surfaces, pale beneath, base usually rounded. Petiole .5—1.5 inches long. Flowers .4 inch diameter, creamy-white, scented, in compact terminal branched cymes 2—4 inches across. Petals minutely adpressed-pubescent outside. Stamens shorter than the petals. Fruit .2—.3 inch long, ovoid, purplish-black, slightly pubescent.

Occurs throughout the hills between 4,500 and 7,500 feet. Common in forests of *Quercus incana*. Flowers: April—June. Fruit: October—February.

According to Hemsley, vide page 333 in Kew Bulletin for 1909, *C. Stracheyi*, Hemsl. based on specimens collected by T. Thomson at Kathi in Kumaun is also distinct from *C. macrophylla*. It is said to differ mainly in the rusty pubescent inflorescence, in the calyx-tube being ecostate and in the conspicuous calyx-teeth.

2. *Cornus oblonga*, Wall. Vern. *Gaunta* or *Gauntia*, G and A.—An evergreen shrub or small tree up to 4 feet girth and 30 feet high. Bark dark reddish-brown, slightly rough, with scattered circular lenticels. Blaze .15—.25 inch, dark reddish-brown with an inner fibrous paler layer. Young shoots minutely adpressed-hairy. Leaves opposite, 4.5 by 1.4.5 inches, narrowly oblong or oblong-lanceolate, narrowed at both ends, entire, shortly acuminate, minutely adpressed-hairy on both surfaces, with tumid glands in the axils of the secondary nerves beneath and sometimes in the axils of the smaller nerves as well, somewhat glossy above, main lateral nerves 5-6 pairs prominent beneath and depressed above. Flowers .3-.4 inch diameter, white, fragrant, the disk the tips of the calyx-lobes the anthers and sometimes the tip of the style purple, in terminal branched cymes 2-3 inches across. Fruit .25—.3 inch long, ovoid, black with a glaucous bloom, containing a brown stone surrounded by succulent green flesh.

Occurs throughout the hills between 4,000 and 7,000 feet. Common in *banj* forest and most abundant and vigorous on a limestone soil. Flowers: September—December. Fruit: April-May.

3. *Cornus capitata*, Wall. Vern. *Bhamōr*, Gen.—A small evergreen tree up to 5 feet girth and 35 feet high. Bark slightly rough, dark reddish-brown or blackish, exfoliating in small polygonal scales. Blaze .2—.4 inch, fibrous, pink or reddish sometimes finely mottled with orange-brown harder tissue. Twigs clothed with short adpressed pubescence. Leaves opposite, 2.5—4.5 by 1.1.5 inches, oblong or elliptic, acute, base narrowed into the petiole, entire, dull bluish-green above, pale and glaucous beneath, rather densely adpressed-pubescent on both sides, with 3—5 pairs of ascending secondary nerves bearing tumid glands in their axils beneath. Petiole .3—.6 inch long, channelled, with dilated connate base. Flowers .15 inch diameter, closely packed in yellowish-green hemispheric heads .5 inch across, each head surrounded by 4 yellow petaloid bracts, the bracteate head 2.3.5 inches diameter.

Fruits coalescing to form a depressed globose head .9—1.2 inches diameter, deep pink or partly orange when ripe, speckled with the remains of the flowers and containing numerous rounded brown stones embedded in a yellow, edible, slightly sweet pulp.

Occurs throughout the hills between 5,000 and 7,500 feet. Fairly common in secondary forest on north aspects. Flowers: June-July. Fruit: October-November.

4. *Cornus controversa*, Hemsl.—A small tree up to 50 feet high and 4 feet girth. Bark smooth, pale grey. Blaze .25—.35 inch, pale yellow with orange streaks. Twigs quite smooth, yellowish-green. Leaves alternate, 4—6 by 2-3 inches, ovate or elliptic, shortly and abruptly acuminate, base rounded or subcuneate, glabrous and shining above, pale and glaucous with adpressed hairs beneath, with 6—8 pairs of arcuate secondary nerves. Petiole 1.2-1.75 inches long. Flowers .4-.5 inch diameter, pure white, unscented, in lax terminal branched cymes 3—5 inches across. Petals glabrous outside. Stamens longer than the petals. Fruit .25 inch diameter, globose, slightly pubescent.

This tree has only been found in the Nawali Reserve of North Garhwal where it occurs bordering the Gurm Toli Gadhera between 6,000 and 7,500 feet. The bark, blaze and alternate leaves serve to distinguish it at once from *C. macrophylla* for which it might otherwise be mistaken. Flowers: May.

3. *TORICELLIA*, DC.

Shrubs or small trees. Leaves alternate, broadly cordate. Flowers small, dioecious, numerous, in pendulous panicles; pedicels short, in the female jointed under the flower, in the male not. Male flowers: calyx-tube short, usually with 5 short blunt lobes. Petals usually 5, rarely 3-4, concave, induplicate-valvate. Stamens usually 5, rarely 3-4. Disk flat. Female flowers: calyx-tube ovoid with short irregularly 3—5-lobed limb; petals and stamens wanting. Disk indistinct. Ovary 3-4-celled; style very short; stigmas usually 3. Fruit a small 1-seeded drupe.

***Toricellia tiliaefolia*, DC.**—A deciduous shrub or small tree up to 4 feet girth with spreading branches. Bark pale brown, slightly rough. Blaze .25 inch, white. Twigs quite smooth, glabrous, stout. Leaves 5—9 by 4—8 inches, broadly ovate or sub-orbicular, obscurely angled or not, coarsely and sharply dentate, broadly cordate, membranous, pubescent on both surfaces when young, glabrous or nearly so when mature, base 3-nerved the lateral pair again branching close to the base, with 3-4 pairs of secondary nerves above the basal. Petiole 2—4 inches long, dilated towards the base and stem-clasping. Flowers numerous, in drooping terminal panicles 8—12 inches long, appearing with the new

leaves. Male flowers green faintly tinged with purplish-brown, with 5 oblong petals and usually 5 conspicuous stamens. Bracts on the male inflorescence; subtending the primary branches lanceolate acuminate .4—.6 inch long; subtending the smaller branches .1—.2 inch long. Drupe .2 inch long, ovoid, purple, glabrous.

Occurs in the central hill ranges between 5,000 and 8,000 feet. Fairly common in East Almora, usually in damp localities in oak forest. Flowers: April. Fruit: October.



XLVIII.—CAPRIFOLIACEÆ.

Small trees or shrubs, erect or climbing. Leaves opposite, rarely ternate; stipules usually wanting. Flowers hermaphrodite, regular or irregular, in cymes or panicles. Calyx adnate to the ovary; lobes 3—5, imbricate. Petals connate in a tubular, funnel-shaped or rotate corolla, 5-fid, with imbricate lobes. Stamens 5, rarely 4, inserted on the corolla-tube alternately with the lobes. Ovary inferior, 2—8 (rarely 1-) celled; style usually simple; ovules solitary. Fruit a drupe with 1—8 cartilaginous pyrenes or a many-seeded berry.

I.—Fruit 1-seeded. Flowers regular.

- | | | | | |
|--|-----|-----|-----|----------------------|
| 1. Leaves usually toothed. Calyx-limb shortly toothed | ... | ... | ... | 1. <i>Viburnum</i> . |
| 2. Leaves usually entire. Calyx-lobes elongate, feathery | ... | ... | ... | 2. <i>Abelia</i> . |

II.—Fruit 3-seeded. Flowers irregular ... 3. *Triosteum*.

•III.—Fruit many-seeded. Flowers often zygomorphic.

- | | | | |
|-------------------------------------|-----|-----|-------------------------|
| 1. Stems solid.* Ovary 2- 8- celled | ... | ... | 4. <i>Lonicera</i> . |
| 2. Stems hollow. Ovary 5-celled | ... | ... | 5. <i>Leycesteria</i> . |

* Note.—The twigs of *L. quinquelocularis* are hollow.

1. VIBURNUM, Linn.

Trees or shrubs. Leaves opposite, simple or lobed; stipules inconspicuous or 0. Flowers in terminal or subterminal umbels, corymbs or panicles. Calyx-tube turbinate or cylindric; lobes 5. Corolla-lobes 5. Stamens 5, inserted on the corolla-tube. Ovary 1—3-celled; ovules 1 in each cell; stigma 3-lobed. Fruit a dry or fleshy drupe, usually 1-seeded; endocarp crustaceous, ridged and furrowed or excavated on one side.

I.—Leaves entire or obscurely crenate.

- | | | | | |
|---|-----|-----|-----|--------------------------|
| 1. Leaves ovate or broadly elliptic, tomentose beneath | ... | ... | ... | 1. <i>cotinifolium</i> . |
| 2. Leaves oblong, glabrous except in the axils of the primary nerves beneath | ... | ... | ... | 2. <i>coriaceum</i> . |
| 3. Leaves narrowly elliptic, glabrous and clothed beneath with pale brown circular scales | ... | ... | ... | 3. <i>punctatum</i> . |

II.—Leaves sharply toothed or serrulate.

- | | | | |
|--|-----|-----|-------------------------|
| A. Flowers in drooping pedunculate panicles, appearing after the leaves. Corolla tubular | ... | ... | 4. <i>erubescens</i> . |
| B. Flowers in erect umbellate or corymbose cymes. | | | |
| 1. Flowers appearing before or with the leaves. | | | |
| (a) Corolla rotate. Leaf-base usually cordate | ... | ... | 5. <i>cordifolium</i> . |
| (b) Corolla tubular. Leaf-base usually acute | ... | ... | 6. <i>nervosum</i> . |
| 2. Flowers appearing after the leaves. Corolla rotate | ... | ... | 7. <i>stellulatum</i> . |

1. *Viburnum cotinifolium*, Don. Vern. *Ghēnu* or *Ghinwa*, G. *Gabian* or *Gwia*, A.—A deciduous shrub 5—15 feet high with stems up to 5 inches diameter. Bark pale often reddish-brown, slightly rough, exfoliating in very small corky pieces. Blaze .25—.3 inch, cheesy, not fibrous, white usually faintly mottled with orange, the whole turning pinkish- or orange- brown on exposure. Twigs more or less stellately tomentose. Leaves 3.5—7 by 2.5—5 inches, ovate elliptic or suborbicular; base cordate or rounded, obscurely crenate, stellately pubescent on both surfaces, often glabrescent above when mature, rather rough above, pale beneath, thickish, nerves impressed above and prominent beneath, main lateral nerves 7—10 pairs. Petiole .3—1 inch long. Flowers .3 inch diameter, white tinged with pink, in stellately tomentose corymbose cymes 2—4 inches across. Corolla-tube .15 inch long; lobes spreading. Drupe .3—.5 inch long, oblong, first red then black, shining, glabrous, containing one flattened and grooved stone embedded in juicy pulp.

Occurs throughout the hills between 6,000 and 11,000 feet. Very common in many types of forest especially oak, often gregarious. The leaves usually turn purplish or pink before falling. Flowers: April—June. Fruit: August—October.

2. *Viburnum coriaceum*, Blume. Vern. *Titmulia* or *Timula*, Gen. *Tita*, NG. *Karua*, SG.—An evergreen shrub 6—12 feet high or rarely a small tree up to 4 feet girth and 25 feet high. Bark dark brown, slightly rough, rather mealy-corky. Blaze .2—.4 inch, pinkish or white with a few reddish-brown markings, the whole turning reddish-brown on exposure. Young shoots puberulous, tinged purplish-red. Leaves 4.5—9 by 1.5—2.75 inches, oblong, acuminate, entire, coriaceous, glabrous except for tufts of hair in the axils of the primary nerves beneath, with 5—10 pairs of lateral nerves very prominent beneath. Petiole .5—1 inch long, usually purplish-pink. Flowers .1 inch diameter, white, sweet-scented, in pedunculate, umbellate, terminal cymes 3—5 inches across; cyme-branches corymbose. Corolla tubular, .15 inch long; lobes small, erect. Anthers exerted, purple. Drupe .15—.2 inch long, ovoid or ellipsoid, dark purple with a thin glaucous bloom.

Occurs throughout the hills between 5,000 and 8,500 feet. Very common in oak forest on shady aspects. The young immature leaves are very conspicuously glossy. If the leaf surface be bruised, as by bending the leaf across, the bruised surface immediately turns whitish due to the glazed epidermal layer flaking off in minute white scaly pieces. Flowers: June—August. Fruit: October—December.

3. *Viburnum punctatum*, Ham.—A small glabrous evergreen tree up to 2.5 feet girth and 40 feet high or sometimes only a shrub. Bark dark brown, rather rough. Blaze .3—.35 inch, pinkish-brown rapidly darkening on exposure. Young shoots covered with pale brown

circular scales. Leaves 4—8 by 1·5—3 inches, narrowly elliptic, shortly and rather abruptly acuminate, base usually acute sometimes rounded, coriaceous, entire, clothed on both surfaces when young with pale brown circular scales which rapidly disappear from the upper surface but persist beneath, very glossy dark green above pale beneath, with 7—10 pairs of lateral nerves, midrib prominent beneath. Petiole 4—8 inch long, rather stout, deeply channelled above, densely clothed with scales. Flowers 2 inch diameter, white, in terminal umbellate cymes 3-4 inches across; cyme-branches corymbose and densely scaly developing lenticels when in fruit. Drupe 3—3·5 inch long, ellipsoid, densely covered with scales.

Occurs throughout the central and inner ranges between 5,000 and 6,500 feet. Rather scarce, usually in shady oak forest and ravines. Flowers: May. Fruit: November-December.

4. *Viburnum erubescens*, Wall. Vern. *Ganni*, CA.—A shrub 6—12 feet high. Bark pale brown, slightly rough on old stems. Blaze 25 inch, hard, pale orange or white finely mottled with orange. Twigs glabrous. Leaves 2—5 by 1-2·5 inches, elliptic or elliptic-oblong, shortly acuminate, base rounded or cuneate, sharply serrulate in the upper half more or less entire in the lower half, glabrous above, stellate-hairy on the nerves beneath when young and with scattered mostly simple hairs (usually tufted in the nerve-axils) when mature, with 5—8 pairs of lateral nerves. Petiole 3—7 inch long. Flowers 2-3 inch diameter, creamy-white or tinged with pink, in solitary, terminal, pedunculate, puberulous or glabrescent, lax, drooping panicles 2—4 inches long. Bracts ligulate, puberulous or glabrous, up to 4 inch long. Corolla-tube 35—45 inch long, the lobes soon reflexed. Drupe 2-3 inch long, ellipsoid, glabrous, red.

Occurs throughout the central and inner ranges between 5,000 and 9,000 feet. Fairly common in Central and East Almora, scarce in Garhwal. Usually in shady oak forest. Flowers: May-June, after the new leaves have formed.

5. *Viburnum cordifolium*, Wall.—A deciduous shrub or small tree. Young shoots densely stellate-hairy. Leaves 3—5·5 by 1·5—3 inches, ovate or elliptic, shortly acuminate, base cordate or rounded, closely and evenly serrulate, sparsely stellate-hairy above and rather densely so beneath when young, glabrous above and glabrescent beneath when mature, with 7 pairs of secondary nerves prominent beneath and reticulate within the margin, with close parallel transverse tertiary nerves. Petiole 7—1·5 inches long, base somewhat dilated, densely stellate-hairy when young. Flowers 3-4 inch diameter, in stellate-hairy terminal umbellate cymes 2-3 inches across with corymbose branches.

Corolla rotate, lobes spreading. Drupe .3—.35 inch long, oblong, glabrous.

Occurs on the central and inner ranges east of the Ramganga between 9,000 and 11,000 feet. Not very common, often associated with *Rhododendron* at about the tree limit. Flowers: May-June. Fruit: October.

6. *Viburnum nervosum*, D. Don. Syn. *V. fœtens*, DCNE. Vern. *Telanu* or *Thelka*, NG.—A large deciduous shrub with spreading stems up to 6 inches diameter and 20 feet high. Bark pale brown or dark grey, somewhat rough and corky. Blaze .25 inch, white inside, pale yellow mottled with orange outside. Leaves 3—7 by 1.75—3.5 inches, ovate elliptic oblong or obovate, acute, serrulate, glabrous or more or less pubescent on the nerves beneath, thin, membranous, base rounded or acute, dark rather glossy green above, pale with 7—9 pairs of very prominent nerves beneath. Petiole .5—1.5 inches long, pink, deeply channelled above. Flowers .4-.5 inch diameter, white, white tinged with pink, or pink, fragrant, appearing before or with the leaves, in terminal erect pubescent cymes 1.2-5 inches across which are branched from the base. Bracts variable, usually large. Corolla-tube .4—.6 inch long, lobes spreading not reflexed. Drupe .4—.6 inch long, ellipsoid, red.

Occurs throughout the central and inner ranges between 7,000 and 11,500 feet. Very common in silver fir and *karshu* forests, often growing under dense cover. The leaves rarely emit a somewhat foetid smell when crushed. Flowers: March-April. Fruit: July-August.

7. *Viburnum stellulatum*, Wall. Vern. *Māleo*, NG.—A deciduous shrub 5—20 feet high with stems up to 6 inches diameter. Bark dark brown often reddish, slightly rough, with prominent small circular lenticels. Blaze .2—.35 inch, white more or less stippled with pinkish-brown, the whole turning orange-brown on exposure. Twigs with a large pith, stellately pubescent. Leaves 3—6 inches long, ovate or ovate-lanceolate, long-acuminate, rather distantly serrate, dull green and glabrous or glabrescent except on the main nerves above, glabrous or slightly stellate-hairy beneath, main lateral nerves 5—8 pairs depressed above and raised beneath. Petiole .5—1.2 inches long, grooved above. Flowers .2 inch diameter, white, strongly scented, in terminal stellately pubescent much-branched, corymbose cymes 4—6 inches across. Drupe .3 inch long, broadly oblong, red, containing one flattened and grooved stone embedded in an acid juicy pulp.

Occurs throughout the hills between 5,000 and 10,500 feet. Common in oak forest on shady aspects. Flowers: June—August. Fruit: October—December.

2. ABELIA, Brown.

Shrubs. Leaves opposite, sometimes ternate, entire or toothed. Flowers axillary and terminal, in small trichotomous cymes or solitary,

2—4-bracteolate. Calyx-tube narrow, striate; limb 5-cleft. Corolla tubular or funnel-shaped; lobes 5. Stamens 4, inserted on the corolla-tube. Ovary 3-celled; style filiform; 2 cells with several abortive ovules, the third with one perfect ovule. Fruit coriaceous, 1-seeded, tipped with the long calyx-teeth.

Abelia triflora, R. Br. Vern. *Badra*, NG. *Kamēra*, Bhotia.—A shrub 6—12 feet high or rarely a small tree up to 3 feet girth and 20 feet high. Bark rough, exfoliating in irregular soft somewhat corky strips. Blaze 1—25 inch, rather fibrous, white. Branches with deep and regular longitudinal fissures 25—5 inch apart. Young shoots clothed with reflexed hairs. Leaves 1·5—3 inches long, lanceolate or ovate-lanceolate, entire or on sterile shoots often with a few coarse teeth or lobes, narrowed upwards from below the middle, pilose when quite young, margins ciliate. Petioles 1·2 inch long, their bases connate. Flowers 4—6 inch diameter, white or tinged with pink, fragrant, in small bracteate 3-flowered cymes crowded in clusters at the ends of the branches. Central flower sessile, pedicels of the lateral 1 inch long. Bracts and bracteoles foliaceous. Calyx-tube with linear, feathery, persistent teeth 3—5 inch long. Corolla-tube 4·5 inch long, with spreading lobes. Fruit dry, narrowly oblong.

Occurs throughout the hills between 6,000 and 10,500 feet. Common on south aspects in shrubby forest or in open forests of *deodar*, cypress or oak. Scarce on the outer ranges and perhaps only found round Naini Tal, where however it is common on the limestone which seems to suit it. Flowers: May-June.

3. TRIOSTEUM, Linn.

Herbs or undershrubs. Leaves opposite, sessile, connate. Flowers whorled in short terminal spikes (axillary in the non-Indian species), 2-bracteolate. Calyx-tube ovoid; lobes 5, short or long and foliaceous, persistent. Corolla narrow funnel-shaped, gibbous at the base; lobes 5, unequal, obtuse. Stamens 5. Ovary 3—5-celled; style filiform; stigma 3—5-lobed; ovules solitary in each cell. Berry 2-3- (rarely 4-5-) celled, 2-3-seeded.

Triosteum hirsutum, Wall.—An undershrub with erect, annual, scarcely woody, stout stems 18 inches high from a perennial rootstock. Stems and leaves clothed with long spreading hairs. Leaves 2·5—5 by 1·5—3·5 inches, the lower pairs smaller and oblong, the upper pairs obovate-elliptic and larger, sessile with connate bases, entire or sinuate. Spikes 1 inch long or less. Calyx-teeth short. Corolla-tube 3—3·5 inch long, green outside, purple inside. Berry 3—3·5 inch long, ovoid or ellipsoid, trigonous, hairy towards the apex.

Occurs on the main Himalayan range in North Almora between 10,000 and 11,000 feet. Flowers: July.

4. LONICERA, Linn.

Erect or climbing shrubs. Leaves opposite, bases sometimes connate, entire or sometimes sinuate; stipules 0. Flowers usually in peduncled pairs, axillary and solitary or in subterminal heads panicles or clusters; bracteoles 2. Calyx-tube ovoid or globose; limb 5-toothed. Corolla often gibbous at the base, limb 5-cleft, regular or nearly so, or 2-lipped, the upper lip erect, 4-toothed, the lower reflexed, entire. Stamens 5, inserted on the corolla-tube. Ovary 2-3-celled; ovules several in each cell; stigma capitate. Fruit a berry, berries distinct or united in pairs.

I.—Leaves more than 1 inch long.

- A. Floral bracts broad, ovate, very conspicuous ... 1. *hispida*.
- B. Floral bracts linear or lanceolate, not conspicuous.
 - 1. Corolla white or yellow usually tinged with pink.
 - (a) Corolla regular or nearly so ... 2. *angustifolia*.
 - (b) Corolla 2-lipped.
 - (i) Mature leaves glabrous or nearly so beneath. Lateral nerves 8—16 pairs ... 3. *orientalis*.
 - (ii) Mature leaves pubescent or tomentose beneath. Lateral nerves 5—9 pairs ...
 - * Peduncle .05 inch long ... 4. *quinquelocularis*.
 - ** Peduncle 1-2 inches long ... 5. *alpigena*.
 - 2. Corolla dull purple ... 6. *purpurascens*.

II.—Leaves less than 1 inch long. (In *asperifolia* sometimes slightly exceeding 1 inch).

- A. Mature leaves glabrous or nearly so.
 - 1. Leaves linear; width less than .15 inch ... 7. *spinosa*.
 - 2. Leaves not linear; width .15 inch or more.
 - (a) Leaves very glaucous ... 8. *glauca*.
 - (b) Leaves not glaucous.
 - (i) Corolla not gibbous at base. Berry red ... 9. *parvifolia*.
 - (ii) Corolla gibbous at base. Berry bluish-black ... 10. *obovata*.
- B. Mature leaves pubescent or tomentose beneath.
 - 1. Leaves suborbicular, ovate or broadly elliptic.
 - (a) Leaves glandular and pubescent above ... 11. *hypoleuca*.
 - (b) Leaves clothed with bristly hairs above ... 12. *asperifolia*.
 - 2. Leaves oblong, lanceolate, or narrowly-elliptic.
 - (a) Leaves woolly-tomentose beneath ... 13. *rupicola*.
 - (b) Leaves finely pubescent beneath ... 14. *microphylla*.

1. *Lonicera hispida*, Pall.—An erect deciduous shrub 1—4 feet high with stems up to 1 inch diameter. Bark pale brown, rough, exfoliating in papery strips and lateral rolls. Young shoots glabrous or

hairy. Leaves 1·3—3·5 by ·6—1·8 inches, elliptic-ovate or lanceolate-oblong, dull dark green and glabrous or with scattered hairs above, pale and hairy with long spreading hairs beneath. Petioles up to ·2 inch long, their bases connate. Flowers ·5—·6 inch diameter, pale yellow, unscented, nodding, on hairy peduncles ·5—1·5 inches long. Bracts ·7—1 inch long, ovate, boat-shaped, hispid, ciliate, foliaceous, green, persistent. Bracteoles 0. Corolla-tube ·6—·8 inch long, funnel-shaped, gibbous, hairy, with rounded lobes. Berries ·2—·4 inch long, oblong or ovoid, dull red, slightly hairy, capped by the persistent calyx and subtended by the persistent bracts.

Occurs along the main Himalayan range and on the dry ranges beyond between 10,000 and 13,500 feet. Scarce. Flowers: June-July. Fruit: August-September.

2. *Lonicera angustifolia*, Wall.—An erect deciduous shrub usually 4-5 feet high but occasionally up to 10 feet with stems 1·5 inches diameter. Bark pale brown, rough, exfoliating in irregular pieces. Young shoots glabrous or pubescent, green. Leaves 1—3 by ·4—1·25 inches, lanceolate or sometimes ovate-lanceolate, narrowed at both ends, more or less pubescent when young, glabrous above and glabrous or pubescent beneath when mature. Petioles ·1—·2 inch long. Bracts ·3—·5 inch long, linear or lanceolate. Bracteoles connate, enclosing the ovaries. Peduncles ·3—1 inch long, slender, puberulous. Corolla ·25—·35 inch long, white tinged with pink, tubular-ventriculose, not gibbous at the base, pubescent; lobes short, rounded. Berries ·3—·35 inch long, ovoid, red, confluent, glabrous.

Occurs throughout the central and inner ranges between 8,000 and 10,000 feet. Common and often gregarious in *karshu* and silver fir forests on shady aspects. Flowers: April-June. Fruit: July-October.

3. *Lonicera orientalis*, Lamk.—A medium-sized deciduous shrub 6—15 feet high with stems up to 5 inches diameter. Bark pale brown, rough, with shallow longitudinal cracks, exfoliating in thin fibrous strips. Blaze ·1 inch, white. Young shoots minutely pubescent or glabrescent. Leaves 2—4 by 1·25 inches, elliptic ovate or ovate-lanceolate, acute, base cuneate or rounded, dull green and glabrous above, paler glaucous and glabrous or nearly so beneath, with 8—16 pairs of secondary nerves slender throughout their length, without glands in the nerve-axils. Petioles ·1—·4 inch long. Bracts ·05—·15 inch long, linear. Bracteoles small or absent. Peduncles ·5—1·3 inches long, slender, glabrous or minutely pubescent. Corolla ·4·5 inch long, pale yellow usually tinged pink at the base, glabrous or pubescent near the base; tube

gibbous at the base; limb 2-lipped, much longer than the tube. Berries 4—5 inch diameter, globose, shining, black, usually confluent.

Occurs throughout the central and inner ranges between 8,000 and 11,500 feet. Fairly common in silver fir spruce and *karshu* forests, often under dense cover and especially on north aspects. Flowers: May—July. Fruit: October.

4. *Lonicera quinquelocularis*, *Hardwick*. Vern. *Badkukra* or *Badru*, G. *Bhati*, A.—A large deciduous shrub 6—12 feet high or rarely a small tree up to 4 feet girth and 20 feet high. Bark pale brown or whitish, rather rough with shallow longitudinal cracks peeling off in fibrous strips. Blaze 1 inch, white. Young shoots densely pubescent. Leaves 1.5—3.5 by 1-2 inches, ovate or broadly lanceolate, obtuse or shortly acuminate, narrowed or rounded at the base, pubescent above when young glabrescent when old, more or less densely pubescent beneath, lateral nerves 6—9 pairs. Petiole .15—4 inch long. Bracts up to .1 inch long, linear, hairy. Bracteoles small, hairy. Peduncles .05 inch long. Corolla .5-.6 inch long, white fading yellow, rather densely pubescent outside; tube only slightly gibbous, a little shorter than the 2-lipped limb. Berries .25—.35 inch long, ovoid, distinct, white, translucent.

Occurs throughout the hills between 4,000 and 10,000 feet. Very common in open forest, often in secondary types. Flowers: April—June. Fruit: November–December.

5. *Lonicera alpigena*, *Linn.*—A medium-sized or large deciduous shrub up to 20 feet high and 3 feet girth. Bark light grey or pale brown, peeling off in copious fibrous strips and exposing the buff-coloured smooth bark beneath. Blaze .15—.25 inch, white, readily separating into distinct layers. Leaves variable in size, 3—7 by 1—3 inches, elliptic to oblong-lanceolate, acute and usually gradually-narrowed, base acute rounded or subcordate, pubescent or glabrescent above, tomentose or sparsely hairy usually with glandular hairs beneath, dull green above, pale but not glaucous with conspicuous glands in the axils of the secondary nerves beneath, secondary nerves 5—8 pairs thickened towards the midrib. Petioles .2—5 inch long. Bracts .1—.25 inch long, linear. Bracteoles small or absent. Peduncles 1-2 inches long, stout, slightly thickened upwards. Corolla .4—.5 inch long, pale yellow, often tinged with pink, hairy and glandular; tube gibbous at the base; limb 2-lipped, much longer than the tube. Berries .3 inch long, ovoid, red, glabrous or glandular-hairy when young, not confluent.

Occurs throughout the central and inner ranges between 7,000 and 13,000 feet. Very common in association with *Betula utilis* along the Dhaul valley in North Garhwal. Fairly common elsewhere in shady oak forest. Flowers: May–June. Fruit: July–August.

6. *Lonicera purpurascens*, *Walp.*—An erect deciduous shrub 4—6 feet high with stems up to 2 inches diameter. Young shoots purplish, pubescent. Leaves 1—3 by .5—1 inch, elliptic oblong or lanceolate,

hairy or glabrous above, more or less tomentose beneath, thin, membranous, with 5—9 pairs of lateral nerves. Petioles .1—·3 inch long. Bracts .2—·3 inch long, linear or linear-lanceolate. Bracteoles small. Peduncles .3—1 inch long, nodding, slender. Corolla .5 inch long, dull purple, funnel-shaped, hairy within and without, gibbous at the base, lobes short. Berries .2 inch diameter, globose, confluent or not, glabrous.

Occurs along the main Himalayan range between 11,000 and 13,000 feet. Very common and often gregarious in forests of *Betula utilis* along the Niti valley, fairly common elsewhere in *karshu* forest. Flowers: May-June. Fruit: August-September.

7. *Lonicera spinosa*, Jacq.—A deciduous shrub with rigid densely-branched erect or procumbent stems usually 6—18 inches high but occasionally up to 3 feet high and 1 inch diameter. Branches usually closely interlaced to form a compact low bush which often contains much spinescent dead wood. Bark rough, dark grey. Leaves .2—·5 by .05—·1 inch, linear-oblong, dull dark rather glaucous green above, pale beneath, margin recurved, glabrous. Petioles less than .05 inch long. Bracts .15—·2 inch long, linear-oblong or lanceolate, foliaceous. Bracteoles small, connate. Peduncles 0—·1 inch long. Flowers fragrant. Corolla .4—·6 inch long, white or white tinged with pink; tube slender, not gibbous, widening upwards; lobes elliptic, less than half the length of the tube. Berries .2 inch long, ellipsoid, not confluent, usually only one of each pair developing.

Occurs on the inner dry ranges bordering Tibet between 11,000 and 14,000 feet. Common and often gregarious over considerable areas of bare sandy and gravelly slopes. Flowers: May-July.

8. *Lonicera glauca*, Hook. f. and T.—A dwarf deciduous shrub with slender spreading erect or decumbent stems 6—9 inches high and up to .5 inch diameter. Bark loose, fibrous, brown. Young shoots pink or pinkish-purple, minutely pubescent or sometimes glabrous. Leaves .3—·8 by .15—·3 inch, oblong or oblong-lanceolate, obtuse or acute with a few stout minute hairs on both surfaces especially on the under-surface and margin or glabrous except the margin, glaucous. Petioles less than .1 inch long, bases connate in pairs, glabrous or pubescent. Bracts .2—·3 inch long, ovate, flat, ciliolate. Bracteoles 0. Peduncle very short. Corolla .6—1 inch long, yellow, the tube slender, glabrous, gibbous at the base, slightly widening near the top with rounded lobes. Berries confluent or not .25—·4 inch long, ovoid or ellipsoid, capped with the persistent calyx, deep orange colour, glabrous.

Occurs on the inner dry ranges bordering Tibet between 12,000 and 14,000 feet. At times it forms dense gregarious patches several feet across on open ground and sometimes it is found growing on rocks. Fruit: July-August.

9. *Lonicera parvifolia*, Hook. f. and T.—An erect or suberect stiff much-branched deciduous shrub usually 1-2 feet high, but stems rarely attaining 4 feet high and 1·5 inches diameter. Bark usually pale brown, sometimes silvery or dark grey. Blaze deeply tinged with chlorophyl. Young shoots minutely glandular-pubescent. Leaves ·3—·8 by ·15—·35 inch, elliptic or oblong, dark green above, paler and reticulate beneath, sometimes puberulous when quite young, glabrous when mature. Petiole scarcely exceeding ·05 inch long. Bracts foliaceous, ·3—·45 inch long, oblong or ovate, glabrous. Bracteoles small, connate. Peduncles ·05—·3 inch long, slender. Corolla ·25—·3 inch long, white or pale yellow often tinged with pink, glabrous; tube cylindric, not gibbous and scarcely widened upwards; lobes rounded, short. Berries ·25—·35 inch long, globose or ovoid, shining, red, not confluent, translucent.

Occurs throughout the central and inner ranges between 10,000 and 12,000 feet. Common and sometimes gregarious on open broken ground above forest level especially amongst boulders or loose rocks, also not uncommon in open *karshu* forest. Flowers: May—July. Fruit: October—November.

10. *Lonicera obovata*, Royle.—A much-branched deciduous shrub with erect or decumbent stems 6 inches to 2 feet high and up to 1 inch diameter. Bark very rough, dark grey or pale brown, exfoliating in thin papery pieces. Blaze white, not tinged with chlorophyl. Young shoots glabrous. Leaves ·3—1 by ·2—·5 inch, obovate or elliptic, base usually cuneate, green above, pale and reticulate beneath, glabrous. Petioles scarcely exceeding ·05 inch long, their bases connate. Bracts ·25—·35 inch long, narrow-linear. Bracteoles small or wanting. Peduncles ·2—·5 inch long, slender. Corolla ·3-4 inch long, greenish-yellow, glabrous; tube widened upwards, gibbous at the base; lobes rounded, short. Berries ·3-4 inch long, ovoid, blue-black with glaucous bloom, confluent.

Occurs along the main Himalayan range between 11,000 and 13,500 feet. Common on broken rocky steep ground above forest level, sometimes also associated with *Betula utilis*. Flowers: May—July. Fruit: August—October.

11. *Lonicera hypoleuca*, Dcne. Vern. *Darbāg*, Bhotia.—An erect deciduous shrub 4—8 feet high with spreading stems often much-branched and forming a dense bush. Young shoots often purplish, pubescent with long spreading hairs some of them gland-tipped. Leaves ·4—1 by ·3—·8 inch, broadly ovate or suborbicular, obtuse or rounded apex, rounded or subcordate at the base, rather thick, glandular and pubescent on both sides, usually densely so beneath, very pale and glaucous beneath. Petiole ·05—·1 inch long. Bracts ·1—·3 inch long, oblong or obovate, foliaceous, glandular and pubescent. Bracteoles small, connate, densely glandular. Peduncles ·15—·4 inch long, hairy

and glandular. Corolla .4—·6 inch long, yellow, fragrant, hairy; tube gibbous at the base; limb 2-lipped, as long as the tube. Berries .2—·4 inch diameter, irregularly globose, not confluent, orange-red, glandular-hairy, half enclosed by the enlarged cupular bracteoles.

Occurs along the Dhauli valley around Kosa and Malari between 9,000 and 10,000 feet. Fairly common and sometimes forming gregarious patches amongst loose boulders or stones in the open. Flowers: May—July. Fruit: August–September.

12. *Lonicera asperifolia*, Hook. f. and T.—A deciduous shrub with erect or decumbent branches 1—3 feet high and stems up to 1·5 inches diameter. Bark yellowish or pale pinkish-brown, peeling off in rough papery strips. Young shoots pinkish-purple with scattered bristly hairs. Leaves .6—1·2 by .4—·8 inch, ovate or elliptic, base rounded or subcordate, upper surface rather densely clothed with bristly hairs when young, glabrous or nearly so and dark green when mature, lower surface hispid. Petiole less than .2 inch long. Bracts .25 inch long, ovate, flat, glandular-pubescent and hispid. Bracteoles 0. Peduncles 0—·3 inch long. Corolla .6—·8 inch long, yellow; tube cylindric, gibbous at the base; lobes elliptic, half the length of the tube. Berries .5 inch long, ovoid, glandular-pubescent at first glabrous when ripe.

Occurs along the inner dry ranges bordering Tibet between 12,000 and 13,500 feet. Common on exposed hill-sides. Flowers: May–June. Fruit: August–September.

13. *Lonicera rupicola*, Hook. f. and T.—A deciduous shrub with rigid densely-branched stems 6—18 inches high and up to 1 inch diameter forming a compact low bush which usually contains much subspinescent dead wood. Bark rough, peeling off in papery flakes, at first yellowish-brown turning grey with exposure. Young shoots more or less woolly. Leaves .3—·9 by .1—·4 inch, oblong or lanceolate, usually obtuse at both ends, more or less clothed above with minute glandular hairs, woolly-tomentose and pale glaucous beneath, margin recurved. Petiole .05—·15 inch long. Bracts linear-obovate, up to .3 inch long, tomentose beneath, glandular pubescent. Bracteoles small, distinct. Corolla .3–·4 inch long, pink, hairy without and within, cylindric; lobes ovate, about half the length of the tube. Berries .15—·2 inch long, ovoid, glabrous, not confluent.

Occurs on the inner dry ranges bordering Tibet between 12,000 and 14,000 feet. Common and usually gregarious on bare sandy and gravelly slopes. Often associated with *Lonicera spinosa*, Jacq. Flowers: June–July. Fruit: August–September.

14. *Lonicera microphylla*, Willd.—An erect stiff much-branched deciduous shrub up to 4 feet high. Leaves .3—·8 by .15—·3 inch, elliptic or oblong, finely pubescent or glabrescent above, finely pubescent beneath. Petiole very short. Bracts about .15 inch long, linear, exceeding the ovaries. Bracteoles 0. Peduncles less than .1 inch long. Corolla about .5 inch long, pale yellow, glabrous outside; tube gibbous

at the base; limb 2-lipped, about as long as the tube. Berries not or partially confluent.

This species is included on the assumption that my specimen number 335 has been correctly identified. It was collected at 12,000 feet elevation in the Girthi valley a mile or two above Malari where it was found growing almost gregariously on open steep rocky slopes. Flowers: May-June. The plant described is var. *robustior*.

5. LEYCESTERIA, Wall.

Small shrubs with fistular stems and branches. Leaves opposite, entire or toothed. Flowers whorled in terminal or axillary spikes subtended by small or large foliaceous bracts, 2-bracteolate. Calyx-tube ovoid, limb unequally 5-lobed, persistent. Corolla funnel-shaped, gibbous at the base, limb subequally 5-lobed. Stamens 5. Ovary 5—8-celled; style slender; stigma capitate; ovules many. Berry many-seeded.

Leycesteria formosa, Wall.—A deciduous shrub with erect stems 5—10 feet high and up to 1·5 inches diameter. Old stems often procumbent with pale brown bark. Young stems hollow, with bright green smooth bark. Leaves 3—7 by 1—3·5 inches, ovate or ovate-lanceolate, long-acuminate, base truncate or rounded, entire or irregularly toothed, thin, membranous, pubescent on both surfaces, dull green above, pale beneath, with 4—7 pairs of lateral nerves. Petioles ·2—1 inch long, connate in pairs, usually tinged purple, flattened above. Flowers in bracteate whorls of 5-6, combined in axillary and terminal drooping pedunculate spikes 1—3 inches long. Bracts foliaceous, sessile, often with connate bases, ciliate, dark red or green tinged with red. Bracteoles similar but smaller. Corolla ·6—·8 inch long, white more or less tinged with pink outside and with 5 yellow spots inside the tube. Berries ·4·5 inch long, ovoid or ellipsoid, turning first red and then black, shining, glandular-hairy, capped by the persistent calyx-limb and containing several small seeds embedded in an evil-smelling brown pulp.

Occurs throughout the hills between 6,000 and 9,000 feet. Fairly common in moist shady forest. Flowers: May—August. Fruit: June—August.

XLIX.—RUBIACEÆ.

Trees, shrubs or herbs, erect, prostrate or climbing. Leaves opposite or whorled, entire; stipules various, inter- or intra-petiolar, very rarely 0. Flowers hermaphrodite, rarely unisexual, usually regular, the inflorescence various. Calyx-tube adnate to the ovary; limb various. Corolla regular, gamopetalous; lobes 4-5. Stamens as many as the corolla-lobes, inserted on its mouth or tube. Disk epigynous, usually annular or swollen. Ovary 2—10-(usually 2-) celled; ovules 1 or more in each cell; style simple or cleft; stigmas various. Fruit 2—10-celled, a berry drupe or capsule or of separating cocci.

I.—Flowers and fruits in globose heads.

A. Trees.

1. Flower-heads ebracteolate, .7—1 inch diameter ... 1. *Anthocephalus*.
2. Flower-heads bracteolate, 1—1.7 inches diameter.
 - (a) Petioles 1.5—4 inches long. Sepals distinct ... 2. *Adina*.
 - (b) Petioles .5—1.5 inches long. Sepals 0 ... 3. *Mitragyna*.

- B. A climber with straight and curved tendrils
 - Flowers ebracteolate ... 4. *Uncaria*.

II.—Flowers not in globose heads.

A. Erect trees or shrubs.

1. Fruit capsular.
 - (a) Usually epiphytic ... 5. *Hymenopogon*.
 - (b) Not epiphytic.
 - (i) Flowers usually purplish, solitary or in pedunculate clusters ... 6. *Leptodermis*.
 - (ii) Flowers blue, in dense clusters arranged in large open panicles ... 7. *Hamiltonia*.
 - (iii) Flowers white, in pyramidal panicles ... 8. *Wendlandia*.
 - (iv) Flowers greenish, in dense spiciform simple or branched racemes ... 9. *Hymenodictyon*.
2. Fruit indehiscent.
 - (a) Flowers small inconspicuous in axillary fascicles ... 10. *Hyptianthera*.
 - (b) Flowers conspicuous, at least .5 inch long or broad.
 - (i) Flowers many in trichotomous cymes.
 - * Styles twice as long as the tube ... 11. *Pavetta*.
 - ** Styles less than twice as long as the tube 12. *Mycetia*.

- (ii) Flowers solitary or fascicled 2-3 together
at the ends of the shoots.
* Unarmed. Fruit a drupe containing 1-2
pyrenes ... 13. *Coffea*.
** Usually armed. Fruit a fleshy or succu-
lent berry.
† Ovary 1-celled ... 14. *Gardenia*.
†† Ovary 2-celled ... 15. *Randia*.
B. A climber ... 16. *Rubia*.

1. ANTHOCEPHALUS, A. *Rich.*

Trees. Leaves large; stipules caducous. Flowers crowded in terminal, peduncled, globose, solitary heads. Calyx-limb with 5 well-developed lobes. Corolla-tube long, funnel-shaped; lobes 5, imbricate. Stamens 5, on the throat of the corolla; filaments short. Ovary 4-celled above, 2-celled below; ovules very many. Style exserted; stigma fusiform. Fruit a fleshy enlarged receptacle on which the capsules are embedded, the capsules having, under the thin envelope, 4 crustaceous caps easily separable from the lower membranous part. Seeds many.

Anthocephalus Cadamba, *Miq.*—Hindi, *Kadam*.—A medium-sized tree attaining 7 feet girth and 60 feet high. Branches spreading horizontally and slightly enlarged at their junction with the main stem. Bark dark brown, roughish, with shallow fissures, exfoliating in small irregular woody scales. Blaze .9—1.3 inches, very fibrous, pale yellow rapidly turning dirty greenish-brown on exposure. Leaves 6—12 by 4—6.5 inches, elliptic-oblong or ovate, acute or shortly acuminate, base usually rounded or sub-cordate and abruptly cuneate on the petiole, glabrous and dark glossy green above with paler midrib and lateral nerves, glabrous or pubescent beneath, coriaceous; secondary nerves 10—14 pairs, prominent beneath, curving upwards towards the leaf-margin, base decurrent on the midrib. Stipules .5-.6 inch long. Petiole 1-2.5 inches long, terete. Flowers small, orange or yellow, in globose heads which are solitary and terminal and 1—1.75 inches diameter. Corolla .5 inch long. Stigmas white, much exserted. Fruit a globose pseudocarp 2—2.5 inches diameter, yellow when ripe.

Occurs in the extreme east of the Haldwani Division where it is found, though rare, growing in moist or swampy ground bordering streams of the subhimalayan tract. There is no reason to suppose it is not indigenous here. Flowers: May (probably).

2. ADINA, *Salisb.*

Trees or shrubs. Stipules large, caducous. Flowers small, crowded in solitary or paniced globose peduncled heads, receptacle hairy. Calyx-tube 5-angled, lobes 5. Corolla-lobes 5, valvate. Stamens 5, on the mouth of the corolla. Ovary 2-celled; ovules numerous; stigma clavate or capitate. Fruit a cluster of capsules each separating into 2 follicular cocci, many-seeded. Seeds winged,

***Adina cordifolia*, Hook. f. Vern. Haldu, Gen.**—A large deciduous tree with the stem often irregularly fluted and buttressed at the base and commonly reaching 20 feet girth and 110 feet high. Bark partly dark grey or blackish and partly pale ashy or silvery-white, rather rough, exfoliating in irregular woody scales. Blaze 1—1·5 inches, soft, with copious short fibre, pinkish-brown but much paler towards the inside, the whole rapidly turning orange-brown on exposure, juice turning black on the blade of a knife. Leaves opposite, 4—10 inches diameter, orbicular, shortly acuminate, base cordate, glabrescent above, pubescent beneath, with 5—8 pairs of lateral nerves. Petiole 1·5—4 inches long, stout, pubescent. Stipules 5—7 inch long, oblong or obovate. Flowers yellow, in globose pedunculate heads 7—1 inch diameter. Peduncles axillary, 1—4 together, 1—4 inches long, each bearing a solitary head (rarely more). Corolla 2·5 inch long, pubescent. Capsules splitting into 2 dehiscent cocci. Seeds many, minute, winged.

Occurs throughout the subhimalayan tract and valleys in the central and outer hill ranges up to 3,000 feet. Common in open miscellaneous forests of the Bhabar, less frequently associated with *sal*. Flowers: June-July. Fruit: April-May.

3. MITRAGYNA, Korth.

Trees or shrubs. Flowers much as in *Adina* but calyx-tube obconic, truncate or with 5 small teeth. Stigma capitate or mitriform. Fruit and seeds as in *Adina*.

***Mitragyna parvifolia*, Korth. Syn. *Stephegyne parvifolia*, Korth. Vern. Phaldu, R. and H.**—A fairly large deciduous tree up to 10 feet girth and 50 feet high usually with a very short bole. Bark pale grey, fairly smooth and covered with numerous small circular lenticels, exfoliating in thick woody plates which leave behind marked depressions. Blaze 5—8 inch, soft with copious short fibre, pink but much paler towards the interior and turning orange-brown on exposure, juice turning black on the blade of a knife. Leaves opposite, variable in size and shape, 2—6 by 1·5—4 inches, elliptic orbicular or obovate, rounded acute or bluntly acuminate at the apex, base acute rounded or subcordate, glabrous above minutely pubescent beneath, sometimes bearded in the nerve-axils, with 6—10 pairs of lateral nerves. Petiole 5—1·5 inches long. Stipules 5 inch long, oblong-spathulate. Flowers greenish-yellow, fragrant, in globose pedunculate heads 7—1 inch diameter. Heads solitary, terminal or in cymes of 3, the terminal head sessile or shortly pedunculate, the lateral on peduncles 1—3 inches long each supported by a pair of foliaceous bracts. Corolla 2·3 inch long. Capsules splitting into 2 dehiscent cocci. Seeds many, minute, winged.

Occurs throughout the subhimalayan tract and outermost hills up to 3,000 feet. Fairly common in miscellaneous forests of the Bhabar. Flowers: June-July. Fruit: May.

4. UNCARIA, *Schreb.*

Climbing shrubs sometimes having some of the axillary peduncles changed into strong recurved hooks. Stipules interpetiolar, entire or bifid. Flowers in solitary or paniced globose heads. Calyx-limb 5-lobed or-partite. Corolla-tube funnel-shaped; lobes 5, valvate or imbricate. Stamens 5, on the throat of the corolla. Ovary 2-celled; ovules many; stigma capitate or clavate. Fruit a head of capsules; each capsule septicidally 2-valved, many-seeded. Seeds winged.

Uncaria pilosa, *Roxb.*—An evergreen shrub with spreading or climbing stems up to 4 inches diameter and 30 feet high. Bark slightly rough with scattered small lenticels. Blaze .3—·5 inch, soft, fibrous, pink with a few yellow bands, the whole turning orange-brown on exposure. Twigs pubescent, usually more or less quadrangular. Leaves opposite, 3—7 by 1·75—3·5 inches, ovate or elliptic, acuminate, base cordate or rounded, thin, rather scabrid, upper surface with short scattered pale hairs, lower surface pubescent, dark green and rather glossy above pale beneath, with 8—10 pairs of arcuate lateral nerves prominent beneath. Petiole .1—·4 inch long. Tendrils axillary, stout, in pairs, either both curved or one curved pointing downwards and one straight pointing upwards, the straight ones up to .3 inch long, the curved up to .8 inch long. Stipules .3 inch long, cut almost to the base into two ovate or oblong-lanceolate halves, green, deciduous. Flowers .2 inch diameter, pale greenish-yellow, scented, in globose pedunculate heads 1·25—1·5 inches across. Peduncles solitary, axial, stout, .5—2 inches long, bracteate above the middle. Calyx .2—·25 inch long; lobes spatulate, longer than the tube, persistent. Corolla .4—·7 inch long; lobes .1 inch long. Pistil club-shaped, much exserted. Capsules .3 inch long, pyriform, pubescent, tipped by the long calyx-lobes.

Occurs throughout the hills between 2,500 and 4,000 feet. Rather scarce. Usually in moist shady ravines. Flowers: June-July: Fruit: October-November.

5. HYMENOPOGON, *Wall.*

Small epiphytic shrubs. Stipules interpetiolar, large, persistent. Flowers in terminal corymbs furnished with large discoloured floral bracts. Calyx-tube obovate; limb 5-partite, persistent. Corolla salver-shaped with a very long tube; limb 5-partite. Stamens 5, included in the inflated summit of the tube. Ovary 2-celled; style filiform with 2 linear lobes; ovules many. Capsule opening at the apex in 2 valves, many-seeded.

Hymenopogon parasiticus, Wall.—A deciduous shrub usually epiphytic but sometimes growing on the ground, especially rocky ground, with stems 1—3 feet long and up to .75 inch diameter. Bark smooth, pale brown, often silvery, exfoliating in thin papery pieces. Leaves opposite, 5—11 by 1.5—4 inches, crowded towards the ends of the branches, obovate or oblanceolate, base gradually narrowed, puberulous on both surfaces, dull-green above pale beneath, with 15—25 pairs of lateral nerves prominent beneath. Petiole 0—3 inch long. Stipules .3 inch long, ovate. Flowers 1.2—1.5 inch long, white, unscented, in terminal erect trichotomous corymbs, each of the 3 primary branches bearing as a rule one greenish leaf-like persistent bract. Bracts oblong 1.5—3.5 by .4—8 inch; stalks .5—2 inches long, flattened. Corolla-tube slender; lobes spreading, clothed with long white hairs chiefly towards the margin. Capsule .5—7 inch long, torpedo-shaped, pubescent, capped by the persistent spreading calyx-lobes.

Occurs throughout the hills between 5,500 and 7,000 feet. Rather scarce. When growing epiphytically it is usually found on *banj*. The leaves turn bright orange-yellow before falling. The empty capsules and bract skeletons often remain attached for many months. Flowers: July. Fruit: November.

6. LEPTODERMIS, Wall.

Shrubs, foetid when bruised. Leaves opposite, the pairs often fascicled; stipules small, acute or pungent, persistent. Flowers white or purplish, crowded into head-like clusters, bracteate and bracteolate; bracteoles connate into a scarious tube. Calyx-tube obconic; lobes 5. Corolla funnel-shaped; lobes 5, valvate with inflexed edges. Stamens 5, inserted in the throat of the corolla. Ovary 5-celled; ovules 1 in each cell. Capsule 5-valved to the base. Seeds surrounded by a fibrous, simple or reticulate coat formed from the inner wall of the ovary.

I.—Corolla glabrous outside 1. *lanceolata*.

II.—Corolla pubescent outside.

(a) Leaves usually exceeding 2 inches long. Lateral nerves 6—10 pairs 2. *kumaonensis*.

(b) Leaves not exceeding 2 inches long. Lateral nerves 4—6 pairs 3. *riparia*.

1. Leptodermis lanceolata, Wall. Vern. *Pidāra* or *Padhēra*, Gen.—An erect deciduous shrub 5—10 feet high with stems up to 3 inches diameter. Bark pale brown, fairly smooth, sometimes thinly corky, with scattered lenticels. Blaze .1—2 inch, white sometimes with indistinct dark veins. Leaves variable in size, 2—5.5 by .7—2.2 inches, lanceolate or ovate, gradually narrowed to an acuminate point, base

acute narrowed into the petiole, scabrid on both surfaces with short stiff pale hairs especially on the midrib above and on the midrib and lateral nerves beneath, lateral nerves arcuate 7—11 pairs. Petiole .2—7 inch long. Stipules hairy. Flowers .4-.5 inch diameter, creamy-white usually but not always turning purplish-pink before falling, sessile, in head-like bracteolate pedunculate clusters. Clusters terminal or axillary, often 2-3 together in the axils of leaves or leaf-like bracts. Peduncles .3—2 inches long, glabrous or rarely pubescent. Calyx .15—.2 inch long. Corolla glabrous outside hairy within, tube .5-.6 inch long, usually curved. Capsule .2 inch long, sub-cylindric. Seed with a loose fibrous covering.

Occurs throughout the hills between 4,000 and 8,000 feet. Very common on open waste grazing grounds and amongst secondary growth, often associated with *banj*. The leaves have a fœtid smell when crushed, especially when young. Flowers: June—October. Fruit. November—January.

2. *Leptodermis kumaonensis*, Parker. Vern. *Pidāra* or *Padēra*.

Gen.—An erect deciduous shrub 4—6 feet high with stems up to 1 inch diameter. Bark dark purplish-brown or blackish, slightly rough, exfoliating in thin papery strips and rolls, with scattered lenticels. Blaze .1 inch, greenish. Leaves variable in size, 2—5 by .7—1.5 inches, lanceolate or elliptic, gradually narrowed to an acute point, base acute narrowed into the petiole, slightly scabrid and puberulous on both surfaces, lateral nerves arcuate 6—10 pairs. Petiole .15—.4 inch long. Stipules hairy. Flowers .4—.6 inch diameter, white or purplish the white ones turning purplish before falling, sessile, solitary or in bracteolate pedunculate clusters of 3—5 flowers. Clusters terminal or axillary, sometimes 2-3 together in the axils of leaves or leaf-like bracts. Peduncles up to .5 inch long, rarely longer, pubescent. Calyx .1 inch long, lengthening in fruit to .2 inch. Corolla more or less pubescent outside, hairy within; tube .4—.7 inch long, curved at the base. Capsule .2—.25 inch long. Seeds enveloped in a loose white netted transparent covering.

Occurs throughout the central and inner ranges between 8,000 and 10,000 feet. Common in *karshu* and silver fir forests. Flowers: June—September. Fruit: October—November.

3. *Leptodermis riparia*, Parker.—A shrub up to 6 feet high. Twigs pubescent. Leaves .8—1.6 by .3—.6 inch, lanceolate, narrowed at both ends, scabrid on both surfaces, ciliate; lateral nerves 4—6 pairs. Petiole .05—.15 inch long. Flowers sessile, white, 3—5 together in a subcapitate fascicle at the ends of the slender branches; bracts connate, encircling the stem. Calyx .1-.2 inch long with ovate ciliate lobes. Corolla .4 inch long, narrowly tubular, puberulous outside, pilose inside;

limb 5-lobed with ovate lobes. Stamens inserted below the throat of the corolla. Style 5-fid, included. Capsule nearly .2 inch long. Seeds enclosed within a loose fibrous bladder.

This shrub has been collected at about 3,000 feet elevation, near Balwakot on the banks of the Kali river in East Almora. Mr. R. N. Parker records that he only found it growing along the banks of streams. Flowers: July.

7. HAMILTONIA, Roxb.

Erect shrubs, foetid when bruised. Leaves opposite, rarely ternate; stipules intrapetiolar, persistent. Flowers in broad trichotomously branched panicles or subumbellate cymes. Calyx-limb with 4-5 subulate, often glandular lobes. Corolla funnel-shaped; lobes 5, valvate. Stamens 5, adnate to the throat of the corolla. Ovary 5-celled, the septa soon disappearing; ovule 1 in each cell; style with 5 linear stigmatic arms. Fruit a 1-celled capsule, 5-valved at the top. Seeds 1—5.

Hamiltonia suaveolens, Roxb. Vern. *Pidāra* or *Padhēra*, Gen.—An erect deciduous shrub 5—10 feet high with stems up to 4 inches diameter. Bark pale silvery-brown, roughish, exfoliating in very thin scales. Blaze .15—.2 inch, not fibrous, pale yellow with fine darker streaks. Leaves 3.5—9 by 2-3.5 inches, elliptic-oblong or ovate, acute, glabrous or pubescent, base narrowed into the petiole; lateral nerves arcuate, 10—16 pairs with smaller ones between. Petiole .1—8 inch long. Stipules .15—.2 inch long. Flowers .5—.8 inch long, blue, sweet-scented but foetid when bruised, in small bracteate head-like clusters on the branches of large, terminal, often leafy panicles up to 2 feet long. Calyx .15 inch long, the lobes somewhat lengthening in fruit, greenish deeply tinged with lilac, persistent. Corolla-tube slender, somewhat widening upwards, hairy outside; limb .25—.35 inch across. Capsules .1—.15 inch long, ovoid.

Occurs throughout the area between 2,000 and 6,000 feet. Very common in dry miscellaneous forests, often on hot southern aspects and rocky ground and frequently associated with *chir*. The young leaves have a strong foetid smell which almost or quite disappears as the leaves mature. Flowers: October—February usually when the plant is leafless or nearly so.

8. WENDLANDIA, Bartl.

Small trees or shrubs. Leaves opposite or ternately whorled; stipules entire or 2-fid. Flowers small, in dense terminal panicked cymes. Calyx-tube subglobose; lobes 4-5. Corolla-lobes 4-5, imbricate. Stamens 4-5, between the corolla-lobes. Ovary 2-rarely 3-celled;

ovules numerous; stigma 2-fid. Fruit a small globose loculicidal capsule, 2-valved.

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| Stipules recurved. Lateral nerves 12—20 pairs | ... 1. <i>exserta</i> . |
| Stipules erect. Lateral nerves 10—12 pairs | ... 2. <i>puberula</i> . |

According to Sir J. D. Hooker in the F. B. 1 and Strachey and Winterbottom in the Catalogue of Kumaon Plants, *W. tinctoria*, DC is also found in our area. I feel however fairly confident that this was a mistake. I have seen at Kew a specimen collected and named by Strachey and Winterbottom from Bageshwar (the locality given by them in their Catalogue) and I am unable to separate it from *W. puberula*. There are also several other sheets at Kew collected in our area and originally named *W. tinctoria* which have since been found to have been wrongly named. *W. tinctoria* is characterised by the leaves having 8—12 pairs of secondary nerves, the stipules being erect, the corolla-lobes shorter than the tube, and the upper leaf-surface glabrous; in other respects it much resembles *W. puberula*.

1. *Wendlandia exserta*, DC. Vern. *Tirchūnia*, BD.—A small evergreen tree 15—30 feet high with stem up to 3 feet girth. Bark rough, exfoliating in irregular woody scales. Blaze .3—·35 inch, soft, cheesy, pink. Twigs densely clothed with short grey pubescence. Leaves 4—9 by 1·5—3·5 inches, lanceolate ovate-lanceolate or narrow-oblong, acute, more or less pubescent above, grey tomentose or pubescent beneath, with 12—20 pairs of lateral nerves. Petiole .5—1 inch long. Stipules ovate, acute, downy, the upper part recurved. Flowers .15 inch diameter, white, fragrant, subsessile, very numerous, in tomentose terminal pyramidal panicles 5—10 inches long and broad. Corolla-tube less than .1 inch long; lobes longer than the tube. Anthers pale, conspicuous. Capsule .1 inch long, grey-tomentose.

Occurs throughout the area up to 5,500 feet. Common, generally in open exposed positions, often on recently-formed landslips. Flowers: March—May. Fruit: April—May.

2. *Wendlandia puberula*, DC. Vern. *Pinchwa*, G.—A large evergreen shrub or small tree up to 15 feet high and 3 feet girth. Bark reddish-brown, rather rough, exfoliating in small irregular scales. Blaze .25—·35 inch, soft, pinkish rapidly turning reddish-brown on exposure. Twigs hairy. Leaves 4—10 by 2·5—4 inches, elliptic-oblong, acute, pubescent on the nerves above, pubescent beneath, with 10—12 pairs of lateral nerves, prominent beneath. Petiole .3—·8 inch long, stout, brown-pubescent. Stipules .25—·5 inch long with broad bases and erect caudate-acuminate tips, pubescent. Flowers .2 inch diameter, white, fragrant, sessile, in terminal tomentose pyramidal panicles 6—10 inches long, the lower branches usually axillary. Corolla-tube about .15 inch long; lobes shorter than the tube. Capsule .1 inch long, nearly glabrous.

Occurs throughout the hills between 2,500 and 5,000 feet. Fairly common, often on steep rocky ground in *chir* forest. The empty fruiting panicles remain attached till the young shoots appear during the cold weather; these are usually bright pink. Flowers: May—June.

9. HYMENODICTYON, Wall.

Trees or shrubs with bitter bark. Stipules interpetiolar, deciduous. Flowers small, in racemes or spikes arranged in panicles, with 1-2 large leafy reticulate persistent bracts; bracteoles small or 0. Calyx-tube short; lobes 5 or 6. Corolla-tube slender, limb 5-lobed; lobes valvate. Stamens 5, inserted at the top of the tube. Ovary 2-celled; ovules numerous; stigma capitate. Fruit a loculicidally 2-valved capsule. Seeds winged.

Racemes paniced, erect. Leaves pubescent above ... 1. *excelsum*.

Racemes simple (rarely branched), drooping. Leaves glabrous above ... 2. *flaccidum*.

1. *Hymenodictyon excelsum*, Wall. Vern. *Boinga*, R.—A medium-sized or large deciduous tree up to 10 feet girth and 80 feet high. Bark dark grey or blackish in parts and pale or silvery-grey in parts, rough, divided up into small polygonal rather corky scales. Blaze 5—1·5 inches, pale yellow mottled with orange or brown, the whole somewhat darkening on exposure. Leaves opposite, 4—10 by 3—5 inches, elliptic ovate-or obovate-oblong, abruptly acuminate, membranous, pubescent on both surfaces, base narrowed, with 7—10 pairs of secondary nerves. Petiole 1—3 inches long. Flowers 2·3 inch long, greenish, fragrant, crowded on the spiciform branches of erect terminal panicles 6—10 inches long, the lower one or more pairs of branches usually subtended by foliaceous persistent bracts which resemble the leaves but are smaller and long-petioled. Stamens short. Styles filiform, much longer than the corolla. Capsules 5—7 inch long, ellipsoid, on stout pedicels ultimately reflexed. Seeds surrounded by a membranous reticulate wing.

Occurs throughout the area between 1,000 and 4,500 feet. Common in dry miscellaneous forests. In the hills it is often only a small tree. Flowers: June—August. Fruit: January—March.

2. *Hymenodictyon flaccidum*, Wall. Vern. *Pinchwa*, G.—A deciduous shrub or small tree up to 3 feet girth and 20 feet high. Bark pinkish-brown, rough, exfoliating in irregular woody scales. Blaze 3—5 inch, not fibrous, pale yellow mottled and streaked with orange and darkening on exposure. Leaves opposite, 6—10 by 3·5-6 inches, broadly elliptic, abruptly short-acuminate, base acute, glabrous above, glabrous or finely pubescent beneath when young, glossy dark green above, paler and somewhat glossy beneath, with 8—10 pairs of secondary nerves. Petiole 1·2-5 inches long, rather deeply channelled above. Flowers 1·5 inch long, greenish-yellow, crowded in drooping, spiciform, axillary, simple (rarely branched) pedunculate racemes 3—8 inches long, usually bearing a single foliaceous persistent bract at the top of the

peduncle. Bracts much smaller than the leaves, long-petioled. Stamens short. Styles nearly twice the length of the corolla. Capsules 4-5 inch long, narrowly ellipsoid, reddish-brown with pale spots, on stout pedicels ultimately reflexed. Seeds surrounded by an elongate membranous wing.

Occurs throughout the hills between 2,000 and 4,500 feet. Scarce. Elsewhere it is said to be frequently epiphytic on trees. I have not noticed this habit in our area, though it frequently grows in crevices amongst rocks. Flowers: May-June. Fruit: February-March.

10. *HYPTIANTHERA*, *W. and A.*

A glabrous shrub. Calyx-tube shortly tubular, lobes 5. Corolla very shortly tubular with 4-5 erect or spreading twisted lobes, very caducous. Anthers 4-5, sessile, inserted by their backs to the tube and nearly included. Disk a pulvinate ring. Ovary 2-celled; style short, villous; stigma 2-cleft; ovules 4-10 in each cell. Fruit small, baccate. Seeds 4-5 in each cell.

Hyptianthera stricta, *W. and A.*—An evergreen shrub up to 15 feet high with stems up to 6 inches diameter. Bark rough, reddish-brown, with numerous shallow longitudinal cracks peeling off in thin almost papery pieces. Blaze 1-2 inch, cheesy, not fibrous, pink, juice turning purple on the blade of a knife. Twigs smooth, green. Main erect shoots quadrangular with decussate side branches. Leaves 4-8 by 75-175 inches, linear-oblong or lanceolate, gradually tapering to an acuminate point, base acute, glossy on both surfaces and dark green above, rather thick, lateral nerves 6-9 pairs. Petiole 15-4 inch long, rather deeply channelled. Flowers small, white, sessile, in axillary fascicles. Corolla 1-15 inch long with broadly ovate lobes. Berries 3-5 inch long, globose or ellipsoid, shining, purplish-black, succulent, crowned with the persistent green calyx.

Occurs along the subhimalayan tract and outer hill ranges up to 3,000 feet, usually in damp shady places and especially along the banks of streams. Rather scarce. Flowers: April-May. Fruit: February-April.

11. *PAVETTA*, *Linn.*

Shrubs or small trees. Leaves opposite; stipules intrapetiolar, usually connate in a loose deciduous sheath. Flowers in trichotomously branched cymes. Calyx-lobes 4, rarely 5. Corolla salver-shaped; tube slender; lobes 4, rarely 5, twisted in bud. Stamens 4, rarely 5, on the mouth of the corolla. Ovary 2-celled; ovules solitary in each cell; style much exserted, slender; stigma fusiform. Fruit a small fleshy berry with 1-2 pyrenes.

Flowers in large cymose panicles 4-8 inches across.

Lateral nerves 10-18 pairs 1. *indica*.

Flowers in small capitate cymes 1.5-2.5 inches across.

Lateral nerves 6-8 pairs 2. *subcapitata*.

1. *Pavetta indica*, Linn.—A shrub 5—10 feet high with stems up to 4 inches diameter. Bark pale brown, slightly rough, soft and mealy or somewhat corky. Blaze .2—·35 inch, cheesy, not fibrous, pale yellow often tinged with chlorophyl. Leaves 5—11 by 2·2—5 inches, elliptic ovate- or obovate-oblong, acute or acuminate, pubescent and dull dark green above with pale midrib, paler and softly pubescent or tomentose beneath, with 10—18 pairs of lateral nerves prominent beneath. Petiole .5—1·5 inches long, hairy. Stipules caudate-acuminate, hairy. Flowers .6—·8 inch diameter, white, sometimes faintly scented, in many-flowered lax trichotomous pedunculate cymose panicles 4—8 inches across. Peduncles axillary, 4—7 inches long, sometimes bearing a few leaves at the base of the panicle. Corolla-tube .5—·7 inch long. Stamens exerted, anthers green. Style projecting .7—·9 inch beyond the mouth of the corolla. Stigma green. Fruit .25—·3 inch diameter, globose, black, puberulous, containing a single large brown seed.

Occurs throughout the area between 1,000 and 5,000 feet. Fairly common, usually in rather open miscellaneous forests. The species described is var. *tomentosa* of F. B. 1. Flowers: May—July. Fruit: January-February.

2. *Pavetta subcapitata*, Hook. f.—A shrub. Leaves 4—7 by 1·25—2 inches, elliptic-lanceolate or oblanceolate, acuminate, base acute, glabrous or nearly so above, glabrous or pubescent beneath, with 6—8 pairs of lateral nerves. Flowers .4 inch diameter, in terminal capitate many-flowered cymes 1·5—2·5 inches across. Corolla-tube .5·6 inch long. Style projecting .5—·8 inch beyond the corolla-tube.

There is a single specimen of this shrub at Dehra Dun collected by Inayat in the Nembuwala Sot in what used to be the Garhwal Division and is now the Lansdowne Division. In the F. B. 1. it is regarded as a possible form of *P. indica*, but it certainly appears quite distinct from *P. indica*, var. *tomentosa* as found in our area. Flowers: May-June.

12. MYCETIA, Reinw.

Shrubs or undershrubs. Stipules simple, free. Flowers in axillary and terminal cymes or corymbs. Calyx-tube turbinate hemispheric or campanulate; lobes 4-5. Corolla salver-shaped, short or long; lobes 4-5, valvate. Stamens 4-5, inserted in the upper part of the tube; filaments very short. Ovary 2-celled with several ovules in each cell; stigmas 2. Berry small, fleshy, many-seeded.

Mycetia longifolia, Kuntze. Syn. *Adenosacme longifolia*, Wall.—A small shrub 1—4 feet high. Bark smooth, yellowish, shining. Leaves 4—10 inches long, elliptic-lanceolate, acuminate, very variable in width, narrowed into the petiole, glabrous or pubescent above, pubescent or tomentose beneath, with about 13—17 pairs of arcuate secondary nerves. Petiole slender, .25—2·5 inches long. Stipules small, oblong-lanceolate, entire or 2-fid. Flowers orange, in broad, terminal and

axillary, trichotomous, glabrous or pubescent cymes. Calyx-tube broadly campanulate, about 1 inch long; teeth ovate, subulate or lanceolate, about as long as the tube, persistent. Corolla about 5 inch long, with small broadly-ovate lobes. Berry 25 inch diameter, globose, white.

Has been found in East and Central Almora between 3,000 and 4,000 feet elevation. Scarce. Usually in damp places. Flowers: July-August.

13. COFFEA, Linn.

Shrubs. Leaves opposite, rarely ternate; stipules broad, interpetiolar. Flowers in axillary or terminal fascicles or solitary or axillary cymes. Calyx-tube short; limb short, 4-5-lobed or irregularly many-toothed. Corolla-tube short or long; lobes 4-5, twisted in bud. Stamens 4-5; filaments short or 0. Ovary 2-celled; ovules solitary in each cell; style bifid at the apex. Fruit a small drupe with 2 plano-convex or ventrally concave cartilaginous or bony pyrenes.

Coffea bengalensis, Roxb.—A deciduous shrub 2—6 feet high with stems up to 1 inch diameter. Bark pale brown or whitish, fairly smooth, the thin outer mealy-corky layer succeeded by green tissue. Young shoots brown-pubescent or glabrescent. Leaves 2.5—4.5 by 1.25—2.75 inches, elliptic or ovate, acute or bluntly acuminate, base acute, dark glossy green and glabrous above, paler and glossy with scattered hairs on the nerves beneath when young; lateral nerves 4—6 pairs depressed above and prominent beneath. Petiole 1-2 inch long. Stipules 2-3 inch long, setaceous, with broad base. Flowers 1—1.5 inches diameter, white, sessile, fascicled 1—3 together at the ends of the shoots. Corolla salver-shaped; tube 7—9 inch long. Drupe 4-5 inch long, truncated-ellipsoid or globose, purplish-black, containing 1-2 pyrenes of a purplish colour flattened on one side with a groove down the middle.

Occurs throughout the subhimalayan tract and outermost hill ranges between 1,000 and 3,000 feet. Rather scarce, generally in shady forest and moist localities, sometimes forming gregarious patches of undergrowth. Flowers: March-April, with the new leaves. Fruit: December-January.

14. GARDENIA, Linn.

Trees or shrubs, armed or not. Leaves opposite, sometimes ternate or fascicled in the thorny species. Flowers usually white, changing to yellow, often large, solitary fascicled or cymose, sometimes dimorphic and polygamous. Calyx-tube ovoid or obconic. Corolla-tube long or short; lobes 5, rarely more, twisted. Stamens as many as the corolla-lobes; anthers sessile or subsessile. Ovary 1-celled; ovules numerous; style thick; stigma club-shaped or fusiform, usually 2-fid. Fruit a coriaceous or fleshy berry, endocarp hard. Seeds many, compressed.

Gardenia turgida, Roxb. Vern. *Thanēra*, Gen.—A small deciduous tree with stout rigid branches, up to 2 feet girth and 25 feet high. Bark quite smooth, pale bluish-grey with well-marked depressions, often coloured paler where pieces have recently exfoliated, covered with a thin mealy scurf. Blaze 3-4 inch, cheesy, not fibrous, pale yellow faintly streaked with pale orange and tinged with chlorophyl towards the outside. Dwarf side-branches sometimes armed with sharp straight axillary thorns. Leaves opposite, usually crowded at the ends of the dwarf shoots or forming terminal rosettes, 2—5 by 1—3 inches, obovate, apex rounded obtuse or acute, base abruptly constricted to form a narrow gradually tapering wing produced almost or quite to the base, coriaceous, upper surface shining glabrous or sparsely hairy, lower surface glabrescent or densely clothed with pale grey hairs. Petiole 0—2 inch long. Flowers 1-sexual and 2-sexual, white, fragrant, 8—12 inches diameter, appearing mostly when the tree is leafless. Hermaphrodite flowers solitary, terminal; ovary 3-4 inch long; calyx 15—2 inch long; corolla-tube 4-5 inch long dilated upwards. Male flowers fascicled at the ends of the shoots. Berries 2-3 inches long, ovoid or ellipsoid, grey or reddish-brown and mealy; pericarp 4—8 inch thick, fleshy; endocarp thinly woody.

Occurs throughout the subhimalayan tract up to 2,000 feet. Fairly common in open *sal* forest on sunny aspects. Flowers: April-May. Fruit March-April.

15. *RANDIA*, Linn.

Trees or shrubs, armed or unarmed, the spines usually in opposite axillary pairs. Leaves often fascicled on short branches and when opposite one of the pair sometimes arrested; stipules short, interpetiolar, free or connate. Flowers often dimorphic, white or yellowish, in axillary or leaf-opposed cymes, sometimes fascicled, rarely solitary. Calyx-lobes 5. Corolla-tube usually short; lobes 5, twisted in bud. Stamens 5. Ovary 2- rarely 3-4-celled; ovules numerous; stigma usually fusiform. Fruit a 2-celled, many-seeded berry.

I.—Unarmed. Leaves usually less than 2 inches long.

Berries not exceeding 3 inch long ... 1. *tetrasperma*.

II.—Armed. Leaves exceeding 2 inches long. Berries more than 2 inch long.

1. Spines 2—4 together at the ends of arrested branchlets. Flowers 1-2 inches diameter ... 2. *uliginosa*.

2. Spines axillary, solitary. Flowers 6—8 inch diameter ... 3. *longispina*.

1. ***Randia tetrasperma***, Benth. and Hook. f. Vern. *Ghāra* or *Gharri*, Gen.—A stiff erect evergreen shrub with stems up to 10 feet high and 3 inches diameter. Bark brown, fairly smooth, exfoliating in rather thick irregular scales. Blaze 25 inch, soft, cheesy, white or

pale yellow with a few pale orange markings towards the interior, often tinged with chlorophyll outside. Leaves very variable, .5—2 by .3—.6 inch, broadly obovate lanceolate or oblanceolate, usually crowded on dwarf shoots, glabrous, base narrowed into a very short petiole. Stipules acute or acuminate. Flowers .8-.9 inch across the expanded corolla-lobes, pale greenish-yellow or creamy-yellow, faintly scented, solitary, sessile or nearly so, terminal. Corolla-tube .4 inch long; lobes spreading at first, later reflexed. The club-shaped pistil protrudes about .2 inch beyond the corolla-tube. Berries .25—.3 inch diameter, globose, black, crowned with the persistent calyx-lobes. Seeds 2—4.

Occurs throughout the hills between 2,500 and 6,500 feet. Common on open slopes and not infrequently associated with *banj*. It sometimes manages to persist on heavily grazed bare slopes when all other woody shrubs have disappeared. Under such conditions it remains dwarfed and frequently only a few inches high. Flowers: March—May. Fruit: January-February.

2. *Randia uliginosa*, DC. Vern. *Pindālu*, R.—A small tree up to 20 feet high and 4 feet girth. Bark reddish-brown, fairly smooth, often with transverse cracks. Blaze .5—.7 inch, pale yellow finely speckled with pale orange or pink. Dwarf shoots often terminated by a cluster of 2—4 stout axillary thorns .25—.5 inch long. Young shoots pubescent. Leaves 3—8 by 1.5—4 inches, elliptic or obovate, usually crowded on dwarf shoots, apex obtuse rounded or acute, base gradually narrowed into the petiole, pubescent on both surfaces when young, glabrous when mature or pubescent on the nerves beneath. Stipules broad, rounded or triangular. Flowers 1-2 inches diameter, white, solitary, terminal, sessile or shortly pedunculate. Calyx-tube .5-.6 inch long, turbinate. Corolla-tube scarcely exceeding the calyx. Berries 2—3.5 inches long, ellipsoid or ovoid, yellow when ripe.

Occurs in the subhimalayan tract, but appears to be rather scarce. It is common in adjacent portions of the plains where it is usually found on low-lying grassy areas. The leaves turn yellow before falling. Long shoots bearing numerous short leafy side shoots often form a characteristic feature of the crown. Flowers May-June. Fruit: March-April.

3. *Randia longispina*, DC. Syn. *R. dumetorum*, Hook. *ex parte*. Vern. *Rāra*, SG. *Madiul*, R.—A large deciduous shrub or small tree with spreading crown and short bole, attaining 4 feet girth and 25 feet high. Bark brown, rather rough, exfoliating in small irregular scales. Blaze .3—.5 inch, crisp, not fibrous, pink, sometimes mottled and streaked with orange-brown, juice turning purple on the blade of a knife. Branches usually armed with strong, straight, axillary thorns .5—2.5 inches long. Leaves 2—6 by .6—3 inches, obovate or elliptic, often fascicled on dwarf shoots, obtuse or acute, more or less pubescent on both surfaces, especially on the nerves beneath, or glabrous above when mature, base gradually narrowed into the petiole. Petiole .1—.5

inch long. Stipules deltoid-acuminate. Flowers .6—.8 inch diameter, yellow, solitary or 2-3 together at the end of dwarf leafy branches. Peduncles short. Calyx-tube .2 inch long, campanulate; lobes as long as or a little shorter than the tube. Corolla-tube .2-.3 inch long, silky without. Berry resembling a small apple, 1—1.5 inches long, globose or broadly ovoid, yellow, sparsely pubescent.

Occurs throughout the area up to 4,000 feet. Very common in *sal* forests and also in dry miscellaneous types. Flowers: April—June. Fruit: January—March.

16. RUBIA, *Linn.*

Herbs or somewhat woody, erect diffuse or climbing, scabrid or prickly; stems 4-sided. Leaves in whorls of 4—8, rarely opposite; stipules wanting. Flowers small, in axillary and terminal cymes, pedicels jointed with the flower. Calyx-tube ovoid or globose; limb 0. Corolla rotate or shortly campanulate; lobes 4—6, valvate. Stamens 4—6, on the tube. Ovary 2-celled; ovules solitary in each cell; style bifid or styles 2; stigma capitate. Fruit small, didymous or globose by the suppression of 1 carpel.

***Rubia cordifolia*, Linn.** Vern. *Majeti*, Gen.—A deciduous climber with weak flexible stems up to 10 feet high and .25 inch diameter. Basal portions of stem usually persistent and often softly woody. Branches quadrangular, retrorsely scabrid or glabrous. Leaves 4 in a whorl, two often larger and with longer petioles, 1.5—4 inches long, ovate, acute, base cordate, scabrid or smooth, with 3—7 strong basal nerves, prominent and usually retrorsely scabrid beneath. Petiole 2—4 inches long. The upper leaves often acute at the base and with shorter petioles. Flowers less than .1 inch diameter, dark red or pinkish-brown, in terminal cymose leafy panicles; the branches trichotomous, spreading, up to 8 inches long, with foliaceous bracts. Fruit .2 inch diameter, globose, dark purple, fleshy.

Occurs throughout the hills between 2,500 and 8,500 feet. Common. Flowers: July—September. Fruit: October—November.



L.—COMPOSITÆ.

Herbs or shrubs, rarely trees. Leaves alternate or opposite, simple or compound; stipules 0. Flowers in heads, consisting usually of many similar or dissimilar flowers, sessile, on the dilated top of the peduncle (receptacle) and surrounded by an involucre of bracts; bracteoles 0 or reduced to scales or bristles on the receptacle. Flowers 1-2-sexual. Calyx-tube adnate to the ovary; limb 0 or of hairs or scales (pappus). Corolla gamopetalous tubular, 2-5-toothed or cleft or ligulate or somewhat bilabiate. Disk epigynous. Stamens 4-5, inserted within the corolla-tube; anthers usually connate in a tube. Ovary inferior, 1-celled; ovule solitary; style usually bifid. Fruit a dry indehiscent achene, naked or crowned by the persistent pappus.

I.—Heads radiate (i.e., corollas of the outer flowers
ligulate, of the inner tubular).

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|---------------------------|-----|-----|-------------------------|
| 1. Ray flowers yellow | ... | ... | 1. <i>Inula</i> . |
| 2. Ray flowers pale mauve | ... | ... | 2. <i>Microglossa</i> . |

II.—Heads disciform (i.e., corollas of all the flowers tubular).

1. Leaves undivided or obscurely lobed towards the base.

(a) Stems thick and succulent ... 3. *Gynura*.

(b) Stems not succulent.

(i) Leaves more or less white-tomentose beneath 4. *Leucomeris*.

(ii) Leaves never white-tomentose beneath ... 1. *Inula*.

2. Leaves 1-2-pinnatifid or -pinnatisect ... 5. *Artemisia*.

1. *INULA*, *Linn.*

Herbs or shrubs. Leaves alternate, toothed. Heads large and solitary or small and corymbose, heterogamous, radiate rarely disciform; ray flowers female, fertile; disk flowers hermaphrodite, tubular. Involucre hemispheric or campanulate, bracts many-seriate, the outer often foliaceous. Receptacle pitted or areolate. Corolla of ray flowers usually ligulate, yellow or white, 3-4-toothed; of disk flowers regular, yellow. Anther-bases with tails. Achene usually ribbed. Pappus hairs rather short.

A. Mature leaves more or less densely silky-tomentose beneath. Flower-heads .25 inch diameter, discoid ... 1. *Cappa*.

B. Mature leaves glabrous or pubescent beneath. Flower-heads .4-1.2 inches diameter, radiate.

1. Lateral nerves 8-12 pairs. Heads .4-.5 inch diameter ... 2. *cuspidata*.

2. Lateral nerves 4-6 pairs. Heads .9-1.2 inches diameter ... 3. *rubricaulis*.

1. *Inula Cappa*, DC.—An erect deciduous or subdeciduous shrub 1—3 feet high with sparingly-branched or unbranched stems up to .5 inch diameter, the shoots often dying back almost to the ground each year, though usually a portion at least persists. Bark smooth, reddish or purplish-brown. Young shoots densely grey-silky. Leaves 3—6 by .7—1.5 inches, oblong-lanceolate, narrowed at both ends, thick, more or less cuspidate-serrate usually obscurely so, dull green and more or less densely adpressed-hairy above, grey silky-tomentose beneath. Petiole 0—4 inch long, stout. Heads .25 inch diameter, yellow, in terminal and axillary corymbs. Flowers all discoid or with few inconspicuous ligules. Involucral bracts linear, silky, the outer shorter. Achenes silky with whitish pappus .25 inch long.

Occurs throughout the area between 1,000 and 8,000 feet. Very common on grassy slopes, especially in open forests of *banj* and *chir*. Flowers: September—November. Fruit: November—April.

2. *Inula cuspidata*, Clarke.—A deciduous or subdeciduous shrub with rather weak freely branching stems 2—6 feet high and up to .5 inch diameter with a large pith. Bark smooth, reddish- or purplish-brown with scattered, raised, circular, pale lenticels. Young shoots glabrous or pubescent. Leaves 3—8 by 1—3.5 inches, elliptic-lanceolate, acuminate, base narrowed, thin, membranous, softly tomentose on both surfaces or glabrescent when young, glabrescent or pubescent beneath when mature, dull green above, closely serrulate, the teeth gland-tipped, with 8—12 pairs of lateral nerves. Petiole .2—1.3 inches long. Heads .4-.5 inch diameter, radiate, bright yellow, in terminal and axillary corymbs arranged in terminal leafy panicles 4—8 inches across; branches clothed with short pubescence. Involucral bracts linear, pubescent, the outer shorter. Achenes silky with whitish pappus .2 inch long.

Occurs throughout the hills between 4,500 and 7,000 feet. Common. It is usually found growing on steep rocky or precipitous ground. Flowers: September—November. Fruit: November—February.

3. *Inula rubricaulis*, Clarke.—A deciduous or subdeciduous shrub with slender erect sparingly-branched stems 2—6 feet high and up to .35 inch diameter with rather a large pith. Bark smooth, pale yellowish-brown. Leaves 4—6 by 1-2 inches, elliptic-lanceolate, acuminate, base narrowed, thin, membranous, serrulate, the teeth gland-tipped, tomentose on both surfaces when quite young, glabrous when mature, with 4—6 pairs of lateral nerves. Petiole 0—1 inch long. Heads .9—1.2 inches diameter, radiate, yellow, in lax few-flowered terminal and axillary corymbs 1.5-4 inches long; branches clothed with long spreading hairs and subtended by large foliaceous bracts. Ray flowers bright yellow, disk flowers orange-brown. Involucral bracts

lanceolate, hairy, the outer shorter. Achenes silky with whitish pappus .25 inch long.

Occurs throughout the hills between 2,000 and 6,500 feet. Not very common, or only locally common. Usually found on steep or rocky ground, often in shady ravines. Flowers: March—May, whilst leafless or nearly so. Fruit: April—June.

2. MICROGLOSSA, DC.

Shrubs, sometimes climbing. Leaves alternate, entire or toothed. Heads heterogamous, radiate, in corymbs often paniculate; ray flowers female, fertile; disk flowers hermaphrodite, often sterile. Involucre campanulate; bracts narrow, the outer shorter. Receptacle flat. Corolla of ray flowers with bifid ligule; of disk flowers with 5 spreading lobes. Anther-bases obtuse. Achenes angular or ribbed. Pappus of hairs.

Microglossa albescens, *Clarke*.—A deciduous shrub 2—4 feet high with spreading erect or suberect stems up to .5 inch diameter. Bark pale brown, often reddish. Twigs with rather a large pith, pubescent. Leaves 2—6 by .75—1.5 inches, lanceolate, acuminate, base gradually narrowed, obscurely serrate with apiculate teeth or subentire with only a few apiculæ, minutely pubescent above, pale and pubescent or tomentose beneath. Petiole 0—.2 inch long. Heads .2-.3 inch diameter, in many-headed terminal corymbs 1.5—3 inches across. Ray flowers female with ligulate pale mauve corollas. Disk flowers bisexual with tubular yellow corollas. Achenes with copious pappus-hairs.

Occurs along the main Himalayan range between 8,000 and 11,000 feet. Not very common. It is usually found growing on rocky or uneven ground in open forest and exposed positions. The crushed leaves have an aromatic smell. Flowers: July-August. Fruit: October-November.

3. GYNURA, Cass.

Succulent herbs, rarely undershrubs, glabrous or hispid. Leaves alternate, entire toothed or pinnatisect. Heads homogamous, disciform, solitary or corymbose, bracteolate at the base; flowers all bisexual, fertile, or rarely a few outer female. Involucre cylindric; bracts 1-seriate, narrow, equal, the margins scarious. Receptacle pitted or shortly fimbriate. Corolla regular, slender, tubular, 5-toothed, yellow. Anther-bases entire or subauricled. Style-arms slender, hairy. Achenes narrow, many-ribbed. Pappus of copious hairs.

Gynura nepalensis, DC.—An erect deciduous undershrub 1—3 feet high with stout sparingly-branched succulent stems up to 1 inch diameter, with a large pith but becoming quite woody towards the base when old. Bark smooth, greenish, with scattered circular lenticels. Blaze not fibrous, green. Young shoots, leaves and inflorescence more or less densely clothed all over with pale pubescence. Leaves 4—9 by 1.3-4

inches, elliptic or elliptic-lanceolate, acute or acuminate, coarsely toothed, base decurrent along the short thick pedicel and sometimes cut into one or more narrow lobes, thick; lateral nerves 5—7 pairs, prominent beneath. Heads .7-.8 inch long and .3-.4 inch across, yellow, in open terminal corymbs 6—12 inches long. Bracteoles about 12, up to .4 inch long, subcylindric, distinct. Bracts about 20, .5-.6 inch long, flattened, with scarious margins by which they cohere till dry. Achenes .15 inch long, linear. Pappus .2-.3 inch long.

Occurs in moist shady ravines throughout the central and outer hill ranges east of the Ranganga Valley between 3,500 and 5,000 feet. Scarce. Flowers: April-May. Fruit: May.

4. LEUCOMERIS, Don.

Shrubs or small trees. Leaves alternate, entire. Heads corymbose, homogamous, discoid, 4—8-flowered, white. Flowers all hermaphrodite, similar and fertile, tubular. Involucre ovoid; bracts many-seriate, coriaceous or dry, the outer smaller. Receptacle flat, naked. Corolla with 5 narrow revolute segments. Anther-bases sagittate with ciliate tails. Achenes 5-ribbed, silky. Pappus of copious hairs.

Leucomeris spectabilis, Don. Vern. *Pandwa*, SG, K and R.—A large evergreen or subdeciduous shrub or small tree with stem up to 2.5 feet girth and 20 feet high. Bark pale brown, rough, corky, split up by reticulate cracks into small rounded scales. Blaze .2—-.7 inch, coarsely fibrous, pale yellowish-brown or white turning dirty green on exposure, juice turning black on the blade of a knife. Shoots angular with a large pith. Leaves 7—16 by 2.5—5 inches, narrowly oblong or oblanceolate, entire or more usually with the nerves excurrent and sometimes minutely cuspidate-serrate, white-tomentose on both surfaces when young soon becoming glabrescent above and ultimately also beneath, base gradually narrowed; lateral nerves 7—14 pairs, prominent beneath. Petiole .3—1 inch long. Heads .7—1 inch long, in terminal tomentose bracteate corymbs 4—6 inches across. Corolla white, tubular. Achenes .2 inch long, slender, densely silky. Pappus .5 inch long, almost concealing the slender corolla-tube when in flower.

Occurs throughout the hills between 2,500 and 6,000 feet. Fairly common in miscellaneous forests, usually on south aspects. Flowers: April-May.

5. ARTEMISIA, Linn.

Herbs or shrubs, usually strong-scented. Leaves alternate, entire serrate or 1—3-pinnatisect. Heads small, heterogamous or homogamous, disciform, usually paniced, sometimes solitary or fascicled; outer flowers female, fertile; inner hermaphrodite, fertile or not. Involucral bracts few-seriate, the outer shorter. Receptacle naked or hirsute. Corolla of female flowers slender, tubular, 2-3-lobed; of hermaphrodite

ones the limb 5-lobed. Anther-bases obtuse. Achenes faintly striate. Pappus 0.

- I.—Flowers all fertile. A suberect shrub with linear leaf-segments 1. *maritima*.
- II.—Ray flowers male, disk flowers hermaphrodite and fertile.
 - A. An erect shrub, the main stem sparingly branched. Leaf-segments more than .05 inch broad 2. *vulgaris*.
 - B. Suberect shrubs, the main stem usually much branched. Leaf-segments less than .05 inch broad.
 - 1. Leaves pale glaucous above, white beneath... 3. *vestita*.
 - 2. Leaves green on both surfaces 4. *sacrorum*.

1. *Artemisia maritima*, Linn. Vern. *Safed-purcha*, Bhotia.—A deciduous shrub 12—18 inches high with stems up to .5 inch diameter. Bark rough, fibrous. Twigs striate, hoary or somewhat white-woolly. Leaves .5—2 inches long, 2-pinnatisect; segments many, small, spreading, linear, obtuse, more or less grey-hoary or -tomentose, bluish-green, the upper leaves simple and linear. Petioles slender, up to 1 inch long, much shorter towards the ends of the shoots. Heads homogamous, 3—8 flowered, oblong or ovoid, a little more than .1 inch long, sessile or nearly so, in spicate fascicles in the axil of a small linear or subsetaceous leaf. Flowers yellowish. Involucral bracts linear-oblong with scarious margins. Corolla with a short cylindric tube and narrowly campanulate limb.

Occurs on the dry interior ranges bordering Tibet between 9,000 and 11,000 feet. Very common and gregarious on open shaly slopes. It bears a general resemblance to *A. vestita*, Wall, but the foliage is paler and more glaucous. The leaves are very aromatic. Flowers: September.

2. *Artemisia vulgaris*, Linn. Vern. *Kunja*, G.—An erect sub-deciduous shrub 3—6 feet high with stems up to .5 inch diameter, old plants usually with a distinct woody and persistent basal portion the upper portion more or less dying back each year. Stems paniculately branched. Lower leaves petioled, 2—4 inches long, ovate in outline, 1-2-pinnatisect with stipule-like lobes at the base; segments more or less pubescent above, ashy-grey or white-tomentose beneath; upper leaves often sessile, linear-lanceolate, entire or 3-fid. Heads heterogamous, sessile or shortly pedicelled, ovoid or subglobose, arranged in somewhat one-sided paniced racemes. Flowers brownish-yellow. Involucral bracts woolly or glabrate, the outer smaller. Achenes minute.

Occurs throughout the area between 1,500 and 12,000 feet. Abundant on waste ground, on roadsides and near cultivation. The leaves are aromatic. Flowers: August—October.

3. *Artemisia vestita*, Wall.—A shrub usually 2-3 feet high, becoming woody at the base in old stems. Twigs striate, canescent. Leaves 1—3 inches long, 2-pinnatisect; segments many, .1—·3 inch long, oblong, acute, undivided or more usually pectinately-pinnatifid, pale glaucous green above, white-tomentose beneath; rachis usually pectinately winged. Heads heterogamous, 6—10-flowered, hemispheric, a little more than .1 inch across, pedicelled, nodding, in compound hoary racemes. Pedicels .05—·2 inch long. Involucral bracts obovate-oblong with scarious margins.

This shrub is recorded by Strachey and Winterbottom as common at 6,000 feet. I have collected what I believe to be this species near Ringi in the Dhauli valley, North Garhwal at 7,500 feet where it is common in blue pine forest. However I may have mistaken the identity of this plant (my Number 1170) since it has heads with as many as 24 flowers in a head whereas 6—10 is the number given in the F. B. I. Leaves scarcely aromatic. Flowers: August.

4. *Artemisia sacrorum*, Ledeb. Vern. *Kala-purcha*, Bhotia.—A deciduous bushy shrub usually 1-2 feet high but occasionally up to 4 feet high and stems up to 1 inch diameter, often decumbent. Bark reddish-brown peeling off in rough loose fibrous strips. Twigs striate, pubescent. Leaves 1-2 inches long, 2-pinnatisect; segments many, .1—·3 inch long, oblong, acute, undivided or more usually pectinately-pinnatifid, green and hoary on both surfaces, ultimately glabrescent above; rachis simple or pectinately winged. Heads heterogamous 15—20 flowered (up to 30 in my specimens), broadly hemispheric, about .15 inch across, pedicelled, nodding, in slender compound pubescent racemes. Pedicels up to .2 inch long. Flowers yellow. Involucral bracts with scarious margins.

Occurs on the dry interior ranges bordering Tibet between 10,000 and 12,000 feet. Very common and gregarious on open shaly slopes. Leaves very aromatic. Flowers: August-September.

LI.—ERICACEÆ.

Trees, shrubs or undershrubs. Leaves alternate, opposite or whorled; stipules 0. Flowers hermaphrodite, regular or rarely slightly zygomorphic. Calyx free or rarely adnate to the ovary, 4—6-fid or -partite. Corolla hypogynous, usually campanulate or urceolate, rarely polypetalous; lobes or petals usually 5, twisted or imbricate. Stamens usually 10, free or attached to the corolla; anther-cells often produced upwards into tubes, sometimes spurred on the back. Ovary usually 5-celled; ovules usually many in each cell; style simple; stigma simple or lobed. Fruit a capsule 5- or more -celled, sometimes appearing baccate from the adherence of the enlarged succulent calyx.

I.—Flowers axillary, usually solitary. Very small shrubs.

- | | | |
|---|-----|------------------------|
| 1. Leaves not imbricate or adpressed to the stem. | | |
| Calyx in fruit succulent | ... | 1. <i>Gaultheria</i> . |
| 2. Leaves imbricate and adpressed to the stem. | | |
| Calyx in fruit unaltered | ... | 2. <i>Cassiope</i> . |

II.—Flowers in racemes. Tree or shrub ... 3. *Pieris*.

III.—Flowers solitary, fasciated or in corymbs. Trees or shrubs ... 4. *Rhododendron*.

1. GAULTHERIA, *Linn.*

Erect or procumbent shrubs. Leaves evergreen, serrulate, with glands on the lower surface at the base of long bristles. Flowers small, sometimes dimorphous, racemose or axillary and solitary. Calyx ovoid, 5-fid; in fruit enlarged, coloured and succulent, enclosing the capsule. Corolla ovoid-tubular. Stamens 10, attached to the base of the corolla; anther-cells more or less produced upwards, dorsally 1-2-horned; in dimorphic flowers the stamens are small with simple anthers. Ovary 5-celled; stigma simple. Capsule 5-celled, loculicidally 5-valved from the apex.

- | | | |
|---|-----|----------------------------|
| Leaves broadly ovate, lower surface setulose... | ... | 1. <i>nummularioides</i> . |
| Leaves narrow-oblong, lower surface glabrous | ... | 2. <i>trichophylla</i> . |

1. *Gaultheria nummularioides*, *D. Don*.—An undershrub with prostrate or creeping densely hirsute stems, partly herbaceous and partly woody, but not exceeding 1 inch diameter. Leaves alternate, 5—8 by 4—6 inch, broadly ovate sometimes suborbicular, acute, base rounded or cordate, glabrous above, setulose beneath and on the margin. Petiole minute. Flowers .25 inch long, pink or white, solitary, axillary.

Pedicels .1 inch long, densely clothed with coriaceous glabrous ovate-oblong bracts .15 inch long. Corolla tubular with minute recurved lobes. Calyx succulent and enlarged in fruit to form a dark blue truncated berry-like fruit .25 inch diameter.

Occurs throughout the hills between 7,000 and 10,000 feet. Common in open oak forest. Flowers: July—September. Fruit: January–February.

2. *Gaultheria trichophylla*, Royle.—An undershrub with erect or prostrate, more or less hirsute stems, partly herbaceous and partly woody, but not exceeding .05 inch diameter and 2–4 inches high. Leaves alternate, about .25 by .1 inch, oblong, subacute or rounded, base cuneate or rounded, glabrous on both sides, glossy above, margins bristly, obscurely serrulate. Petiole minute. Flowers .2 inch long, pink or nearly white, solitary, axillary. Pedicels .1 inch long, densely clothed with ovate bracts .1 inch long. Calyx enlarging in fruit as in the preceding species.

Occurs along the slopes of the main Himalayan range between 10,000 and 12,000 feet. Fairly common. Flowers: June–August.

2. CASSIOPE, *D. Don*.

Small fastigate shrubs. Leaves small, rigid, densely imbricate, adpressed to the branches. Pedicels axillary. Sepals 5, free, thickened at the base, imbricate. Corolla campanulate; lobes 5. Stamens usually 10, slightly attached to the base of the corolla; filaments linear; anthers truncate with 1-2 horns divaricate from beneath the summit of each cell. Ovary 5-celled; stigma simple; ovules many in each cell. Capsule loculicidally 5-valved.

***Cassiope fastigiata*, *D. Don*.**—An undershrub with slender woody stems up to .2 inch diameter, the basal portion usually procumbent, the terminal portions erect forming dense tufts 4–8 inches high. Leaves .2 inch long, somewhat 4-fariously imbricate, ovate-oblong, thick but with a narrow membranous margin which is prolonged into a cuspidate point, the thickened back with a narrow longitudinal groove which opens into a cavity in the leaf. Flowers .3 inch long, white, solitary or 2–4 together. Pedicels 0–.3 inch long, woolly. Corolla-tube widely campanulate with short recurved lobes. Capsule as long as the persistent calyx-segments, globose, apex depressed. Seeds minute.

Occurs along the main Himalayan range between 11,000 and 13,000 feet. It is found on open slopes above the forest, and is often more or less gregarious in patches. Flowers: June–July.

3. PIERIS, *D. Don*.

Trees or shrubs. Leaves alternate. Flowers in axillary or paniced racemes at the ends of the branches. Calyx 5-fid or -partite, valvate. Corolla with 5 short lobes. Stamens 10, usually with 2 horns divaricate from the apex. Ovary globose, 5-celled; stigma capitellate; ovules many in each cell. Capsule loculicidally 5-valved. Seeds minute.

Pieris ovalifolia, D. Don. Vern. *Ayār*, Gen. *Angyār*, NG.—A deciduous shrub or small tree up to 8 feet girth and 20 feet high. Bark reddish-brown, rough, with somewhat regular vertical furrows 1-2 inches apart, often deeply cleft, exfoliating in loose fibrous strips. Blaze .5—3 inches, almost entirely composed of dead tissue. Leaves 2.5—6 by 1—3 inches, ovate or elliptic, acute or acuminate, entire, base rounded, coriaceous, more or less tawny-pubescent on both surfaces when young, glabrous or glabrescent when mature. Petiole .2—5 inch long. Flowers .3—5 inch long, white, in simple terminal and axillary racemes 2—6 inches long, a few flowers towards the base of the raceme usually in the axils of small leaves, all the flowers directed downwards. Pedicels .15—3 inch long. Calyx-segments .1—25 inch long. Corolla ovoid, pubescent without. Filaments with or without 2 minute apical horns. Capsule .2 inch diameter, globose, supported by the persistent calyx.

Occurs throughout the hills between 2,000 and 11,500 feet. Very common especially in association with *banj*. A very large specimen in Garhwal measured 12 feet girth and 25 feet high. At high elevations this species becomes a shrub and some botanists have separated this under the name *P. villosa*, Hook. f. The main distinction lies in the absence of horns to the filaments which are supposed to be invariably present in the case of *P. ovalifolia*. The calyx-segments in the former are also longer and narrower. I have found the two growing together at 9,500 feet elevation at the head of the Nandagiri valley and as I could discover no more distinctive characteristics than those mentioned above I have preferred to regard them as one species. Flowers: April—June. Fruit: January—February.

4. RHODODENDRON, Linn.

Trees or shrubs; often scaly or aromatic. Leaves alternate, entire, coriaceous. Flowers fascicled or subcorymbose, terminal, rarely solitary or axillary. Calyx 5-lobed, persistent, sometimes small or obsolete. Corolla-tube long or short, limb 5—10-lobed, somewhat zygomorphic. Stamens 5—18, usually 10. Ovary usually 5-celled; ovules many in each cell; stigma capitate. Capsule more or less woody, septicidal. Seeds numerous, often tailed or crested.

I.—Trees or shrubs exceeding 3 feet high. Leaves more than 3 inches long. Flowers in corymbs.

1. Calyx-lobes .1 inch long or less.

(a) Leaves with small silvery scales beneath.
Flowers red or pink 1. *arboreum*.

(b) Leaves with a cinnamon- or buff-coloured
tomentum beneath. Flowers pale mauve 2. *campanulatum*.

2. Calyx-lobes .15 inch long or more. Leaves
pale yellowish-green and glabrous beneath.
Flowers bright red 3. *barbatum*.

II.—Small shrubs not exceeding 3 feet high. Leaves less than 2 inches long.

1. Flowers pale yellow in 4—12-flowered corymbs 4. *Anthopogon*.

2. Flowers bright red, solitary or 2-3 together 5. *lepidotum*.

1. **Rhododendron arboreum**, *Smith*. Vern. *Burāns*, *G. Brons*, A.—A small evergreen tree up to 5 feet girth and 25 feet high. Bark pinkish-brown, somewhat rough, exfoliating in thin flakes. Blaze .2—·5 inch, white or pinkish. Young shoots clothed with white scales. Leaves 3—6 by 1·2—2·2 inches, crowded towards the ends of the branches, lanceolate or oblong, narrowed at both ends, glabrous and glossy green above, pale beneath from a film of small white scales, the midrib and nerves prominent beneath. Petiole stout, .5—1 inch long, clothed with white scales when young. Flowers 1-2 inches long, deep red or pale pink, crowded in large rounded corymbs. Pedicels 0—·3 inch long. Corolla campanulate. Ovary mealy or rusty-wooly. Capsule 1 by .3 inch, cylindric, curved, mealy, longitudinally ribbed.

Occurs throughout the hills between 4,000 and 11,000 feet. Very common and often associated with *banj* and *karshu*. The pale flowers are usually seen at high elevations. I have measured a tree in South Garhwal which was 16·5 feet girth at 1·5 feet above the ground. Flowers: January—June, flowering first at low elevations.

2. **Rhododendron campanulatum**, *D. Don*. Vern. *Chimula* or *Semru*, NG.—An evergreen shrub often only 6—8 feet high but sometimes 15—20 feet high with stems up to 3 feet girth. Stems spreading and nearly always procumbent towards the base. Bark smooth, pinkish-brown, exfoliating in thin almost papery flakes. Blaze .1 inch, pale orange- or reddish-brown. Leaves 3—5 by 1·7—2·5 inches, crowded towards the ends of the branches, elliptic or elliptic-oblong, rounded at both ends, mucronate, glabrous and glossy dark green above, clothed beneath with a dense cinnamon- or buff-coloured tomentum which obscures the nerves, midrib prominent beneath, leaf margins often curved inwards towards the midrib beneath. Petiole stout, .4—·8 inch long. Flowers 1—1·5 inches long, white tinged with mauve or lilac and spotted inside anteriorly with pinkish-purple, in lax corymbs. Pedicels .7—1 inch long. Corolla campanulate. Ovary glabrous. Capsule .7—1·2 by .25—·3 inch, cylindric, more or less curved, longitudinally furrowed.

Occurs along the main Himalayan range between 9,500 and 12,500 feet. Very common and often densely gregarious over fairly large areas, sometimes associated with *karshu* on north aspects but more usually with *Betula utilis* or extending above the limits of tree growth. Flowers: May—July. Fruit: October–November.

3. **Rhododendron barbatum**, *Wall*. Vern. *Chimula* or *Semru*, NG.—A large evergreen shrub or small tree up to 4 feet girth and 30 feet high. Stems often procumbent towards the base. Bark quite smooth, bright reddish-brown sometimes vinous-red, flaking off in thin papery strips and exposing a paler bark beneath. Blaze .1 inch, pinkish or orange usually tinged with chlorophyl. Young shoots glabrous. Leaves 4·5—9 by 1·25—2·5 inches, crowded towards the ends of the branches,

narrowly elliptic-oblong or oblong-oblongeolate, apex submucronate, base rounded or slightly cordate, glabrous and dull or slightly glossy and dark green above, glabrous (sometimes bristly in Nepal specimens) and pale yellowish-green beneath, midrib prominent beneath. Petiole '3—'8 inch long, stout, usually with a few coarse bristles up to '25 inch long on the upper surface. Flowers 1'3—1'6 inches long, bright red, crowded in corymbs. Pedicels '25—'5 inch long. Corolla campanulate. Ovary densely glandular-hairy. Capsule '7—1'2 by '25 inch, cylindric, curved, longitudinally ribbed.

Occurs along the main Himalayan range, between 8,000 and 10,500 feet. Fairly common, usually on north aspects and often associated with silver fir or *karshu* and sometimes with *Betula utilis*. Flowers: May-June.

4. *Rhododendron Anthopogon*, D. Don.—A small evergreen shrub 1-2 feet high with stems up to '75 inch diameter, the basal portion more or less procumbent and densely branched. Bark slightly rough, pinkish-brown or grey, exfoliating in papery strips. Young shoots scaly and pubescent. Leaves '5—1'3 by '3—'8 inch, crowded towards the ends of the branches, elliptic or elliptic-oblong, thick, margins recurved, clothed above with scattered yellow scales when young, becoming glabrous when mature, clothed beneath with a dense layer of scales which are yellow on the young leaves becoming ferruginous as the leaves mature, subobtusate at both ends. Petiole '1—'3 inch long. Flowers '6—'8 inch diameter, very pale yellow and almost translucent, in dense 4—12-flowered corymbs. Pedicels very short. Corolla-tube '3—'5 inch long, cylindric; lobes spreading, elliptic-obovate. Ovary scaly. Capsule '1—'2 inch long, ovoid, tapering gradually to a blunt point, prominently 5-ribbed, dotted with pale yellowish scales and capped by the short erect style '05 inch long.

Occurs along the main Himalayan range between 10,000 and 14,000 feet. Common above tree level, usually on north aspects, often forming dense gregarious patches of large extent on steep or boulder-strewn ground. The leaves turn purplish-brown above in the autumn. Flowers: June-July. Fruit: October-November.

5. *Rhododendron lepidotum*, Wall. Vern. *Tāghisha*, NG.—A small shrub 6 inches to 3 feet high with erect stems up to '35 inch diameter often curved at the base. Bark pale brown, slightly rough. Young shoots reddish-brown with scattered scales. Leaves '6—1'75 by '25—'5 inch, crowded towards the ends of the branches, oblanceolate or oblong-oblongeolate, acute or rounded at the apex, more or less densely dotted on both sides with rounded scales, subsessile. Flowers 1—1'25 inches diameter, bright red or magenta, solitary or 2-3 together. Pedicels '5—1 inch long, scaly, the same bright colour as the corolla. Corolla-tube '2 inch long, as broad as or broader than long; lobes

spreading, rounded. Ovary scaly. Capsule .3 inch long, oblong, tapering upwards, prominently 5-ribbed, the tip clothed with pale yellowish scales and capped by the stout persistent curved style .15 inch long.

Occurs throughout the central and inner ranges between 8,500 and 14,000 feet. Common on all aspects, often forming gregarious more or less dense patches on open steep ground and bare grassy slopes. The leaves turn beautiful shades of red, orange and yellow before falling; they are somewhat aromatic. Flowers: June-July. Fruit: October-November.

LII.—PLUMBAGINACEÆ.

Herbs or undershrubs. Leaves alternate, the radical usually rosulate; stipules 0. Flowers hermaphrodite, regular, capitate racemed or paniced on terminal scapes or peduncles. Calyx inferior, gamosepalous, tubular, 5—10-ribbed, lobes 5. Corolla hypogynous, of 5 petals free or connate at the base or united in a linear tube. Stamens 5, opposite the petals; filaments nearly free or adnate below to the corolla. Ovary superior, 1-celled, 5-angular above; ovule 1; styles 5, free or connate below. Fruit capsular, membranous or with a hardened apex, rupturing near the base or circumsciss, apex often 5-valved.

PLUMBAGO, *Linn.*

Perennial herbs or undershrubs, often scandent. Leaves entire. Flowers in terminal spikes. Calyx covered with stalked glands. Corolla-tube long, slender; lobes 5, spreading. Stamens free. Capsule circumsciss at the base, hardened above.

Plumbago zeylanica, *Linn.*—A deciduous shrub with weak trailing stems which when supported by surrounding vegetation attain 6 feet high and .35 inch diameter. Twigs green, smooth, striate, with a large pith. Leaves 1.5—3 by .8—1.8 inches, ovate, subacute, entire, glabrous, thin, glaucescent beneath, base abruptly narrowed. Petiole .5—1 inch long, margined in the upper half, amplexicaul at the base which is often dilated into stipule-like auricles. Flowers .4-.5 inch diameter, white, in lax spikes 2—6 inches long. Calyx .4-.5 inch long, green often tinged pink, densely clothed with sticky glandular hairs, the five ribbed lobes cohering by a thin pale membrane. Corolla-tube slender, .6—.9 inch long; lobes spreading. Capsule circumsciss near the base and splitting upwards into 5 valves, oblong, as long as the persistent green calyx.

Occurs throughout the area up to 4,000 feet. Fairly common in open scrub forest and hedges. Flowers: April—November. Fruit: November–December.



LIII.—MYRSINACEÆ.

Trees, shrubs (erect or climbing) or undershrubs, generally evergreen. Leaves alternate or sometimes opposite, simple, usually gland-dotted; stipules 0. Flowers regular, hermaphrodite or polygamodiceous. Calyx inferior (in *Mæsa* adnate to the ovary), 4—6-lobed, persistent, sometimes enlarged in fruit, often with glandular dots or lines. Corolla-tube usually short or none; lobes 3—7. Stamens as many as and opposite to the corolla-lobes; anthers sometimes connate. Ovary 1-celled; ovules few or many; stigma simple, rarely shortly lobed. Fruit usually baccate and indehiscent.

I.—Flowers in axillary fascicles ... 1. *Myrsine*.

II.—Flowers in racemes or panicles.

A. Leaves entire, glabrous, thick, with very inconspicuous secondary nerves ... 2. *Ardisia*.

B. Leaves more or less serrate, secondary nerves distinct.

1. Leaves obscurely serrulate in the upper half. Stem usually scandent ... 3. *Embelia*.

2. Leaves rather coarsely serrate. Stem erect... 4. *Mæsa*.

1. *MYRSINE*, Linn.

Trees or shrubs, usually glabrous. Leaves coriaceous, entire or toothed. Flowers small, in sessile or shortly pedunculate axillary fascicles, polygamous or dioecious. Calyx free, 4-5-lobed. Petals 4-5, connate or free, imbricate or valvate. Stamens inserted at the base of the corolla. Ovary free; style short or subobsolete; stigma large, capitate or lobed. Fruit small, globose, 1-seeded.

Leaves 5—1 inch long. Flowers subsessile... 1. *africana*.

Leaves 2.5—6.5 inches long. Flowers pedicellate ... 2. *semiserrata*.

1. *Myrsine africana*, Linn. Vern. *Ghani*, A.—An erect evergreen shrub usually 2—4 feet high with stems up to .75 inch diameter but occasionally up to 8 feet high. Bark pale brown or grey with scattered lenticels. Young shoots pubescent. Leaves 5—1 inch long, lanceolate or obovate, sharply toothed, dotted with resinous glands when quite young, minutely puberulous on the midrib above otherwise glabrous. Petiole minute. Flowers minute, subsessile, in axillary clusters of 3—8. Anthers red at first. Drupe .2—2.5 inch diameter, globose, dark purple containing a single seed surrounded by purplish fleshy tissue.

Occurs throughout the hills between 3,000 and 7,000 feet. Very common and gregarious in shady oak forests, usually on north aspects. Flowers: March—May. Fruit: February—May.

2. *Myrsine semiserrata*, Wall.—An erect evergreen shrub usually 3—6 feet high but stems occasionally up to 15 feet high and 6 inches diameter. Bark pale brown, smooth, lenticellate. Blaze .2—·25 inch, pale yellow or pinkish with pink or red reticulate streaks. Young shoots pubescent. Leaves 2·5—6·5 by .75—1·25 inches, lanceolate, acuminate, sharply serrate the fine-pointed serratures turned upwards from the plane of the leaf, rarely entire, dotted with small pink glands along the margin on the undersurface, glabrous, rather thick. Petiole .1—·25 inch long. Flowers .1 inch diameter, in dense axillary fascicles. Pedicels .05—·25 inch long. Anthers greenish. Drupe .25—·3 inch diameter, globose, smooth, shining, white tinged with purple or turning first pink then blue, containing a single whitish seed surrounded by fleshy white tissue.

Occurs throughout the hills between 4,500 and 7,000 feet. Common in shady oak forest and often gregarious in patches. As a rule the pedicels are very short and do not exceed .1 inch long, but there are two specimens at Dehra Dun collected in East Kumaon showing the pedicels fully .25 inch long. According to Carl Mez in Das Pflanzenreich this variation is found in *M. semiserrata* but it would be interesting to examine more specimens of both forms from this area. Flowers: November—April. Fruit: October—March.

2. *ARDISIA*, Swartz.

Shrubs or small trees. Leaves entire or toothed, usually gland-dotted. Flowers hermaphrodite, in simple or compound umbels or racemes. Calyx 5-rarely 4-lobed. Corolla white or pink, usually 5-lobed, lobes twisted to the right in bud. Ovary narrowed upwards; stigma small. Fruit a globose or subglobose berry.

Leaves lanceolate or oblanceolate, 1-2 inches broad.

Flowers in panicles 1. *floribunda*.

Leaves obovate, 2-3·5 inches broad. Flowers in

racemes 2. *solanacea*.

1. *Ardisia floribunda*, Wall. Syn. *A. neriifolia*, Wall.—An evergreen shrub up to 10 feet high and 3 inches diameter. Bark pale brown, fairly smooth with distant lenticels. Blaze .15—·25 inch, not fibrous, deep reddish-brown or on young stems pink streaked darker, juice turning dark purple on the blade of a knife. Leaves 4—9 by 1—1·75 inches, narrowly lanceolate or oblanceolate, acute, base narrowed, entire, rather thick, lateral nerves scarcely distinguishable, glossy on both surfaces but especially beneath, glabrous. Petiole .2—·7 inch long. Flowers .1—·15 inch diameter, pink, in subterminal or axillary, pedunculate, minutely-rusty panicles 2—6 inches long. Pedicels .1—·25 inch

long, usually umbellately clustered. Fruit .25 inch diameter, depressed-globose often irregularly shaped, first red but finally turning black, containing a single small seed surrounded by purplish pulp.

In the subhimalayan tract this species has been collected near Bhalaon in the Ramnagar Division, and in the hills it has been collected near Askot in East Almora. It is also reported to occur in the Ranikhet and Central Almora Divisions. Though locally fairly common it is generally scarce. It is usually found on the banks of streams and rivers. Flowers: May-June. Fruit: January-February.

2. *Ardisia solanacea*, Roxb. Syn. *A. humilis*, F.B.I. ex parte.—

An erect evergreen shrub 5—15 feet high with stems up to 6 inches diameter. Branches numerous, spreading horizontally and swollen at their junction with the main stem. Bark pale brown, fairly smooth, with small raised circular lenticels. Blaze .25—.75 inch, not fibrous, pink to reddish-or yellowish-brown, faintly streaked darker towards the inside and with purple or red specks towards the outside. Twigs stout. Leaves 5—10 by 2.5—3.5 inches, oblanceolate or obovate, acute or shortly acuminate, base narrowed, entire, rather thick and fleshy, dark green above, slightly glossy on both surfaces, lateral nerves indistinct, glabrous. Petiole .2—1 inch long, stout. Flowers .6—.8 inch diameter, pink, waxy, in axillary pedunculate elongate or contracted racemes 1.5—6 inches long. Pedicels .4—.8 inch long, lengthening in fruit, thickened upwards. Fruit .4—.6 inch diameter, globose and often depressed, first red then purplish-black, shining, containing one large brown seed surrounded by juicy pinkish pulp, seated on the persistent green calyx and crowned with the persistent style.

Occurs throughout the subhimalayan tract and in the central and outer ranges up to 4,000 feet. Very common in *sal* forest bordering ravines and in shady depressions. Flowers: May-June. Fruit: February-April.

3. EMBELIA, Burm.

Small trees or shrubs, usually climbing. Leaves alternate, entire or toothed. Flowers small, hermaphrodite or polygamo-dicæous, in simple or compound racemes. Calyx free, 4-5-lobed. Petals 4-5, free or slightly connate at the base, imbricate in bud. Stamens inserted on the corolla. Ovules few; style short; stigma capitate. Fruit a small globose usually 1-seeded berry.

***Embelia robusta*, Roxb.**—An evergreen shrub with spreading branches or climbing with rambling and drooping branches; stems up to 6 inches diameter and 30 feet high. Bark pale brown, fairly smooth. Blaze .35—.5 inch, cheesy, not fibrous, pink or pinkish-brown with fine paler stripes. Branches reddish-brown with numerous minute pale lenticels, unarmed or with stout thorns up to 1 inch long. Young shoots pubescent, often purplish. Leaves 2.5—6.5 by 1.5—4 inches, ovate elliptic or obovate, acuminate, usually more or less serrulate in the upper

half, thin, pubescent or nearly glabrous above, with scattered white (rarely rusty) stellate pubescence beneath or nearly glabrous; lateral nerves 6—9 pairs impressed above prominent beneath. Petiole .3—.8 inch long, pubescent. Flowers .2-.3 inch diameter, pale greenish tinged with purple in the centre, in axillary and extra-axillary pubescent racemes; racemes solitary or 2-3 together, simple or rarely branched, 1—5 inches long. Pedicels .1-.2 inch long. Drupe .15 inch diameter, globose, bright red or purplish-red, fleshy, crowned with the slender style.

Occurs throughout the area up to 5,500 feet. Fairly common in the subhimalayan tract, rather scarce in the hills. Flowers: July—September. Fruit: December—February.

4. *MÆSA*, *Forsk.*

Trees or shrubs, erect or straggling. Leaves entire or serrate. Flowers small, hermaphrodite or unisexual, in terminal or axillary, simple or compound racemes. Calyx-tube adnate to the ovary; lobes 4-5. Corolla campanulate, 4-5-lobed, the lobes imbricate. Stamens inserted on the tube; filaments short. Ovules numerous; stigma capitate or shortly 3—5-lobed. Fruit a small dry or fleshy globose berry.

Leaves glabrous or nearly so beneath, 1-2 inches broad.

Racemes 1—3 inches long 1. *indica*.

Leaves softly pubescent beneath, 2.5—4.5 inches broad.

Racemes .4—.8 inch long 2. *argentea*.

1. *Mæsa indica*, *Wall.* Vern. *Jiundāli*, *G. Gadchiana*, NG.—

An evergreen shrub 5—15 feet high with stems up to 3 inches diameter. Bark pale brown, slightly rough. Vigorous shoots often deep purplish-green with numerous pale circular lenticels. Young shoots glabrous. Leaves 3—6 by 1-2 inches, lanceolate or oblong-lanceolate, acuminate, distantly serrate-dentate, membranous, glabrous above, glabrous or nearly so and pale beneath; lateral nerves 5—10 pairs. Petiole .4—.6 inch long. Flowers .15 inch diameter, white, scented, in simple or compound erect axillary glabrous racemes 1—3 inches long. Pedicels .05—.1 inch long, slender. Berry .15 inch diameter, globose, pinkish, succulent, almost covered by the persistent calyx and usually tipped with the style.

Occurs throughout the hills between 2,000 and 6,000 feet. Common in ravines in chir forest and in open oak forest on north aspects. It is often gregarious in patches. Flowers: February-March. Fruit: December—February.

2. *Mæsa argentea*, *Wall.*—An evergreen shrub 4—8 feet high with spreading succulent or softly woody stems up to 1.25 inches diameter. Bark reddish-brown, lenticellate. Twigs hollow. Young shoots densely clothed with spreading hairs. Leaves 5—10 by 2.5—4.5 inches, elliptic or elliptic-oblong, acute or shortly acuminate, base cuneate acute, serrate,

rather thick, finely and softly pubescent or both surfaces when young, especially along the nerves, sometimes glabrescent above when mature, dull green above, lateral nerves 8—14 pairs. Petiole .5—1.2 inches long. Flowers about .1 inch diameter, whitish or pale greenish-yellow, in simple or compound axillary hairy racemes .4—.9 inch long. Pedicels .05—.1 inch long. Berry .15—.2 inch diameter, globose, pinkish or nearly white, succulent, almost covered with the persistent calyx.

Occurs throughout the hills between 4,500 and 8,000 feet. Rather scarce, generally found in ravines or in moist shady forest. Flowers: April-May. Fruit: December.



LIV.—SAPOTACEÆ.

Trees or shrubs usually with milky juice, young parts often rusty-tomentose. Leaves alternate rarely subopposite, entire; stipules 0 or very caducous. Flowers hermaphrodite, axillary; pedicels clustered, rarely solitary or paniced. Calyx-lobes 4—8, imbricate or biseriate with the outer ones valvate. Corolla-tube short; lobes as many as or 2—4 times as many as those of the calyx. Stamens inserted on the tube, 1—3 times as many as the corolla-lobes, or some reduced to staminodes, 1—3-seriate. Ovary superior, sessile, 2—8-celled; ovules solitary in each cell; style linear; stigma a point. Fruit an indehiscent 1—8-seeded berry.

BASSIA, *Linn.*

Trees with milky juice. Leaves coriaceous, clustered at the ends of the branchlets. Flowers fascicled, axillary or from the axils of fallen leaves. Calyx-lobes 4, rarely 5, the 2 outer usually valvate enclosing the 2-3 inner imbricate. Corolla campanulate; lobes 6—14, usually 8—10, contorted in bud. Stamens 12—40; connective produced. Ovary villous; cells 4—12, usually 6 or 8. Fruit a fleshy berry, usually 1—3-seeded.

Leaves with 10—14 pairs of secondary nerves. Corolla-tube .4-.5 inch long, fleshy. Stamens 22—26 ... 1. *latifolia*.

Leaves with 13—18 pairs of secondary nerves. Corolla-tube .25 inch long, thick but not fleshy. Stamens 30—40 ... 2. *butyracea*.

1. *Bassia latifolia*, *Roxb.* Vern. *Mahwa* or *Mohwa*, Gen.—A medium-sized deciduous tree up to 8 feet girth and 60 feet high, with rather dense rounded crown. Bark dark brown or blackish, slightly rough with shallow cracks and sometimes a few long deep ones, exfoliating in small irregular woody scales. Blaze .5—.7 inch, coarsely fibrous, bright pink to dark reddish (banded paler on immature stems), exuding a milky juice. Young shoots pubescent or tomentose. Leaves 5—9 by 2.5—4.5 inches, elliptic or elliptic-oblong, shortly acuminate, pubescent or tomentose when young, ultimately glabrous or nearly so, coriaceous, lateral nerves 10—14 pairs. Petiole 1—1.5 inches long. Flowers .5 inch diameter, cream-coloured, in dense fascicles near the ends of the branches below the terminal leaf-bud. Pedicels 1—1.5 inches long, drooping, rusty-pubescent or tomentose. Corolla fleshy; tube .4-.5 inch long, ovoid, with 7—14 (usually 8-9) erect lobes. Stamens

22—26. Berry 1-2 inches long, green, fleshy, ovoid. Seeds 1—4, 1—1·5 inches long, pale brown, shining.

Occurs along the subhimalayan tract up to 3,000 feet, and is sometimes cultivated in the hills up to 4,000 feet. Fairly common in *sal* forest. Flowers: March-April. Fruit: June-July.

2. *Bassia butyracea*, *Roxb.* Vern. *Chiūra*, Gen.—A medium-sized deciduous tree up to 6 feet girth and 40 feet high. Bark dark reddish-brown, fairly smooth on young stems becoming rough on old ones, exfoliating in irregular thin woody scales. Blaze 4—7 inch, bright pink with pinkish or yellowish bands in the outer half which turn orange on exposure, inner half rather fibrous, exuding a milky juice which turns purple on the blade of a knife. Young shoots tomentose. Leaves 8—14 by 3·5—6 inches, obovate obovate-oblong or elliptic, obtuse or acute, entire, base acute, dark rather glossy green above and pubescent when young but becoming glabrous with age, clothed more or less densely with long adpressed pale hairs beneath; lateral nerves 13—18 pairs prominent beneath. Petiole 5—1 inch long, stout, terete, rusty-pubescent. Flowers 8—1 inch diameter, white, with a sickly fragrance, crowded in fascicles chiefly just below the leaves and sometimes a few between the leaves. Pedicels 7—1·1 inches long, curved downwards, rusty-tomentose. Corolla-tube 25 inch long, cylindric slightly dilated upwards, somewhat thickened but not fleshy with 8—12 lobes spreading at first but soon recurved. Stamens 30—40. Berry 8—1·75 inches long, ellipsoid, green, shining. Seeds usually 1—2.

Occurs in the subhimalayan tract and outer hill ranges up to 4,000 feet and is sometimes also planted in the hills. Fairly common. Flowers: January-February. Fruit: June-July.

LV.—EBENACEÆ.

Trees or shrubs. Leaves alternate, rarely opposite, entire, usually coriaceous; stipules 0. Flowers usually dioecious, regular, axillary, solitary clustered or shortly cymose; pedicels articulate under the flower. Calyx inferior, gamosepalous, often accrescent. Corolla gamopetalous, lobes 3—7, usually overlapping to the right. Stamens in male flowers as many or 2-3 times as many as the corolla-lobes, free or filaments more or less grouped; in female flowers absent or reduced to staminodes. Ovary sessile, 2—16-celled; ovules 1-2 in each cell; styles 2—8, free or connate at the base. Fruit a coriaceous or fleshy berry, number of seeds variable.

DIOSPYROS, *Linn.*

Trees, rarely shrubs. Flowers dioecious, rarely polygamous, males mostly in cymes, females usually solitary. Calyx 4-5-(rarely 3-) lobed, usually deeply, the female often larger than the male and frequently hardened in fruit. Corolla with usually as many lobes as the calyx, lobes twisted to right in bud. Stamens in male flowers 4-many, often 16, the filaments paired or variously connate; staminodes in female flowers 0—16. Ovary 4—16-usually 8-celled, ovules solitary in each cell; styles short. Fruit often supported by the enlarged sometimes woody calyx.

I.—Leaves often opposite or subopposite. Bark black or blackish and rough ... 1. *tomentosa*.

II.—Leaves alternate.

A. Evergreen. Leaves 5—9 inches long, glabrous when young. Bark fairly smooth ... 2. *Embryopteris*.

B. Deciduous. Leaves under 6 inches long, pubescent when young.

1. Bark quite smooth, dark greenish-brown. Fruit clothed with deciduous red scurf ... 3. *montana*.

2. Bark rough, blackish. Fruit orange-yellow without scurf ... 4. *cordifolia*.

1. **Diospyros tomentosa**, *Roxb.* Vern. *Tendu*, K and R.—A small or medium-sized deciduous tree up to 6 feet girth and 45 feet high. Bark blackish, with shallow or deep cracks, exfoliating in rectangular or polygonal small scales with flat faces usually about 5 inch diameter, the fissures deeper and the scales more regularly disposed on young stems. Blaze 25—5 inch, rather coarsely fibrous, pink sometimes streaked with orange, the outer dead tissue black. Young shoots tomentose. Leaves opposite, subopposite or alternate, 3—9 by 2—5 inches, broadly ovate,

elliptic or oblong, base usually rounded, apex usually obtuse, very coriaceous, tomentose when young becoming glabrous above and ultimately glabrescent beneath, dull dark green above. Petiole '3—'5 inch long, stout. Male flowers '25 inch long, '15 inch across the calyx, in tomentose shortly-peduncled simple or branched cymes. Female flowers '5 inch long, '4 inch across the calyx, solitary, subsessile or on short thick peduncles. Fruit 1—1.5 inches diameter, globose or ovoid, hairy when young, smooth and yellowish when ripe, seated on the coriaceous enlarged calyx.

Occurs throughout the subhimalayan tract up to 3,000 feet. Very common in open *sal* forests especially on clay soils. Flowers: April-May. Fruit: May-June of the following year.

2. *Diospyros Embryopteris*, Pers.—A small evergreen tree up to 6 feet girth and 40 feet high with a short deeply-fluted trunk and spreading rounded crown of dense foliage. Bark blackish or very dark brown, fairly smooth with scattered small circular lenticels, exfoliating in rather thick irregular woody scales. Blaze '25—'5 inch, cheesy, not or very shortly fibrous, pink or reddish, juice turning purple on the blade of a knife. Twigs smooth, green, terete. Leaves alternate, distichous, 5—9 by 1.2-2.5 inches, oblong, acute or obtuse, base rounded or obtuse, coriaceous, glabrous, smooth and glossy on both surfaces especially above where the dark green is relieved by the conspicuous pater midrib. Petiole '2—'6 inch long, flattened above. Flowers white, fragrant. Male flowers '4 inch long in few-flowered umbellate cymes. Peduncles '3—'5 inch long, pubescent. Female flowers '5 inch long, 1 inch across the calyx, axillary, solitary. Peduncles stout, '5 inch long. Fruit 1—1.75 inches diameter, globose, covered with deciduous rusty-brown scurf, containing several large seeds embedded in a viscid pulp, seated on the persistent leathery green calyx.

There are no specimens from this area at Dehra Dun, and I did not see any at Kew so that I am doubtful whether it occurs or not. It is however common in low-lying and swampy localities in the Dehra Dun, where it is somewhat gregarious. Fascicles of short black adventitious roots 1-2 inches long not infrequently appear on the lower portions of the trunk. They may be simple or branched and probably play the rôle of pneumatophores. Flowers: March-May. Fruit: July-August.

3. *Diospyros montana*, Roxb. Syn. *D. Kanjilali*, Duthie.—A small deciduous tree up to 4 feet girth and 25 feet high with short bole and spreading crown. Bark dark greenish-brown or greenish-grey, smooth, densely covered with binute pale lenticels which tend to coalesce in vertical lines; branches often bluish-grey. Young shoots glabrous or pubescent. Blaze '3—'5 inch, cheesy, not fibrous, pale yellow sometimes mottled with orange, rapidly turning bright orange on exposure. Leaves 2.5—6 by 1.5—2.5 inches, ovate-oblong or elliptic, acute or subacuminate, base usually rounded, rather

coriaceous, glabrescent or tomentose when young, glabrous or pubescent when mature, dull dark green with paler yellowish venation above, pale and somewhat glossy beneath. Petiole .2-.3 inch long. Male flowers .4 inch long, green, in 3-several-flowered cymes. Peduncles .2-.5 inch long. Pedicels very short. Female flowers .5 inch long and .5-.75 inch diameter, solitary. Peduncles .15-.3 inch long. Fruit up to 1 inch diameter, globose, covered with a deciduous red scurf.

Occurs along the outer hill ranges between 1,000 and 4,000 feet. Fairly common in dry miscellaneous forest. Flowers: April-May. Fruit: December-February.

4. **Diospyros cordifolia**, Roxb.—A small deciduous tree, the trunk and main branches often armed with stout simple or branched thorns up to 3 inches long. Bark blackish, rough with numerous shallow cracks, exfoliating in small thin woody scales. Blaze yellowish-brown or yellow vermiculated and finely streaked with orange, the whole rapidly turning orange. Young shoots pubescent. Leaves alternate, 1.5-4 by .5-1.5 inches, oblong, acuminate or sometimes obtuse, base cordate or rounded, thin, softly pubescent on both sides, ultimately glabrescent. Petiole .15-.25 inch long. Male flowers .25 inch long and .2 inch diameter, white, in axillary pedunculate usually 3-flowered cymes. Peduncles .2-.3 inch long. Pedicels .1 inch long. Corolla campanulate with short spreading lobes. Female flowers white; corolla-tube urceolate-campanulate, .2 inch long; limb .5 inch diameter; solitary. Peduncles .2-.5 inch long. Berry 1-1.5 inches diameter, globose, orange-yellow with several reddish-brown seeds banded with black and surrounded by translucent mucilage and yellow pulp.

There are no specimens from our area at Dehra Dun, but Strachey and Winterbottom record its occurrence in the Kotah Dun between 1,000 and 2,000 feet. Mr. H. H. Haines says that this species is sometimes evergreen in damp localities in Bihar and Orissa. Flowers: March-May. Fruit: January.

100

LVI.—STYRACEÆ.

Trees or shrubs. Leaves alternate, simple, exstipulate. Flowers hermaphrodite, regular, usually white, axillary or terminal, solitary or in simple or compound spikes or racemes. Calyx-tube adnate to the ovary, 5-4-toothed or truncate, persistent. Petals usually 5, free or shortly connate at the base, sometimes connate in a tube, imbricate. Stamens 8—10 or many with free or connate filaments, often in bundles and more or less adnate to the corolla. Ovary inferior, 2—5-celled; ovules 1—4 in each cell; style filiform; stigma usually capitate. Fruit drupaceous or leathery, 1—3-seeded.

SYMPLOCOS, *Linn.*

Leaves toothed or entire. Racemes or spikes axillary, sometimes much reduced. Sepals 5, small, imbricate. Petals 5, free or connate at the base. Stamens many, several-seriate, adnate to the bases of the petals. Ovary usually 3-celled; ovules 2 in each cell. Fruit a drupe.

I.—Flowers pedicelled.

- | | |
|--|------------------------------|
| 1. Flowers in many-flowered panicles... | ... 1. <i>crataegoides</i> . |
| 2. Flowers in about 7—15-flowered simple racemes ... | ... 2. <i>racemosa</i> . |
| 3. Flowers in 3—6-flowered simple racemes ... | ... 3. <i>ramosissima</i> . |

II.—Flowers sessile.

- | | |
|--------------------------------------|-----------------------------|
| 1. Spikes 5—1 inch long ... | ... 4. <i>theaeifolia</i> . |
| 2. Spikes more than 1 inch long. | |
| (a) Secondary nerves 7—9 pairs ... | ... 5. <i>spicata</i> . |
| (b) Secondary nerves 10—14 pairs ... | ... 6. <i>ferruginea</i> . |

1. *Symplocos crataegoides*, *Buch.—Ham.* Vern. *Lōdh*, Gen.—A small deciduous tree up to 5 feet girth and 25 feet high. Bark rough, yellowish-brown, deeply furrowed, corky and fibrous. Blaze 3—5 inch, fibrous, pale yellow. Young shoots hairy. Leaves 1.5—4 by 1-2 inches, ovate or elliptic, acute or acuminate, base rounded or cuneate, more or less sharply serrate with gland-tipped teeth, pilose on the midrib above when young, glabrous or pilose on the nerves beneath. Petiole .2-.3 inch long, hairy when young. Flowers .25 inch diameter, white, fragrant, in cymose corymbs arranged in axillary and terminal panicles 1—3 inches long. Fruit .25—3 inch long, oblong or ovoid, bluish-black, containing a single large brown seed surrounded by blue pulp.

Occurs throughout the hills between 3,500 and 9,500 feet. Common in oak forests. Flowers: April—June. Fruit: October—December.

2. *Symplocos racemosa*, Roxb.—A small evergreen tree with stems up to 20 feet high and 6 inches diameter. Bark dark grey, rough. Blaze .3—.5 inch, shortly fibrous, pale yellow finely mottled with pale orange-brown. Leaves 3.5—7 by 1.25—2 inches, elliptic-oblong or elliptic-lanceolate, apex acute obtusely-acuminate or obtuse, serrulate obscurely crenate or rarely entire, base acute cuneate, coriaceous, glabrous above, pubescent beneath when young but ultimately glabrous or with scattered spreading hairs mainly on the midrib, glossy on both surfaces, dark green above; lateral nerves indistinct (distinct when dry) 5—9 pairs. Petiole .3—.7 inch long. Flowers .4-.5 inch diameter, white fading yellow, in simple axillary pubescent racemes .5—3.5 inches long. Bracts ovate, tomentose. Calyx glabrous. Pedicels .05—.2 inch long. Drupe .4-.5 inch long, oblong, glabrous, purplish-black, crowned with the persistent calyx.

Occurs along the subhimalayan tract and in the outer hills up to 4,500 feet. Rather scarce, sometimes associated with *sal*. Flowers: December-January. Fruit: May-June.

3. *Symplocos ramosissima*, Wall.—A small evergreen tree up to 3 feet girth and 30 feet high. Bark dark brown, fairly smooth. Blaze .3—.35 inch, soft, pale yellow often tinged with chlorophyl towards the exterior. Young shoots pubescent. Leaves 3.5—7 by 1—1.75 inches, narrowly oblong, acuminate often caudate, obscurely crenate-serrate, base cuneate acute, glabrous, dark glossy green above with distinct pale venation, lateral nerves 6—9 pairs. Petiole .2—.4 inch long. Flowers .3-.4 inch diameter, white, in 3—6-flowered simple axillary pedunculate pubescent racemes. Pedicels .05—.1 inch long. Calyx-tube villous; lobes puberulous. Bracts ovate, pubescent. Drupe .2-.3 inch long, ellipsoid or subglobose, dark blue or black containing a spherical brown seed surrounded by deep blue soft tissue, pubescent when young.

Occurs throughout the hills between 4,000 and 8,500 feet. Common in shady forests of *Quercus incana* and *Quercus dilatata*, especially the latter, and often gregarious. Flowers: June-July. Fruit: November—March.

4. *Symplocos theæfolia*, D. Don.—An evergreen shrub or small tree up to 1.5 feet girth and 20 feet high. Bark fairly smooth, dark brown, with scattered pale circular lenticels. Blaze .25—.35 inch, fibrous, white or tinged pink. Young shoots glabrous. Leaves 3.5—5.5 by 1.25—1.75 inches, elliptic-oblong, acuminate sometimes caudate, obscurely crenate-serrate, base cuneate acute, glabrous, coriaceous, dark glossy green on both surfaces, the midrib and secondary nerves pale above; lateral nerves 8—13 pairs. Petiole .3—.6 inch long, sparsely hairy when young. Flowers .2 inch diameter, yellow, in congested, many-flowered, axillary, pubescent spikes .5—1 inch long, branched near or at the base. Bracts ciliate. Calyx-tube

glabrous; lobes minutely ciliate. Drupe .4-.5 inch long, elliptic, glabrous, containing a single elongated seed.

Occurs in the central ranges of hills between 6,000 and 7,500 feet, but not recorded west of Lohba. Fairly common in the East Almora Division, usually in shady oak forest. Flowers: March—April. Fruit: September–October.

5. *Symplocos spicata*, Roxb.—A small tree. Leaves 3–7 by 1.5–2.5 inches, lanceolate elliptic or oblong, serrate serrulate or subentire, acute or acuminate, base narrowed, glabrous, with 7–9 pairs of secondary nerves. Petiole .3-.4 inch long. Flowers .25-.3 inch diameter, white, sessile, in simple or branched axillary spikes 1–3.5 inches long. Spikes with pubescent rachis and small ovate pubescent bracts and bracteoles. Calyx glabrous or nearly so. Drupe .25 inch diameter, globose or ovoid, crowned with the persistent calyx.

Mr. W. J. Lambert has collected this species at Thal in East Almora at 3,200 feet elevation, and this is the only specimen we have at Dehra Dun from our area. It is likely to occur along the outer ranges between 1,000 and 4,000 feet. Flowers: October.

6. *Symplocos ferruginea*, Roxb.—A small tree up to 4 feet girth and 25 feet high. Bark reddish-brown, slightly rough, lenticellate. Blaze .3-.35 inch, pale yellow mottled or streaked with pale orange-brown. Leaves 6–12 by 1.5–3.5 inches, narrowly oblong elliptic or oblanceolate, acute or acuminate, serrulate, base acute, coriaceous, glabrous except for a few long reddish-brown hairs on the midrib beneath and sometimes also on the secondary nerves beneath, dark rather glossy green above; lateral nerves 10–14 pairs, parallel, joined by loops within the margin. Petiole .35-.9 inch long, stout, channelled above. Flowers .3-.35 inch diameter, white, sessile, in branched axillary rusty-villous spikes 1.5–4 inches long. Bracts ovate, tomentose. Calyx more or less villous. Drupe .2-.25 inch diameter, subglobose, crowned with the persistent calyx blue-black with a thin glaucous bloom when ripe.

Occurs in the North Garhwal Division where it is generally scarce though locally not uncommon, as for instance in the Khatersami reserve and again near Gupta Kasi. It also occurs in the Naini Tal division near Patwadunga. It is found in moist shady localities between 4,000 and 5,500 feet. The species here described is var. *polystachya*, F. B. I. Flowers: September–November. Fruit: October–December.



LVII.—OLEACEÆ.

Trees or erect or climbing shrubs, unarmed. Leaves opposite, very rarely alternate, simple 3-foliolate or pinnate, exstipulate. Flowers hermaphrodite, often dimorphous, sometimes polygamous or dioecious, regular, usually in trichotomous cymes or panicles, rarely fascicled or racemose. Calyx inferior, campanulate, truncate or lobed. Corolla usually gamopetalous; lobes 4—9 or 0, imbricate or valvate; tube long, or short. Stamens 2 (in Indian species), inserted on the corolla-tube, or, if petals free or 0, hypogynous. Ovary free, 2-celled; ovules usually 1-2 in each cell; stigma simple or 2-lobed. Fruit a loculicidal capsule, or indehiscent, or a succulent berry or drupe.

- I.—Trees with pinnate leaves
 - 1. Fruit a winged nut 1. *Fraxinus*.
 - 2. Fruit a woody capsule 2. *Schrebera*.
- II.—Shrubs, usually scandent, with simple or pinnate leaves. Fruit a berry 3. *Jasminum*.
- III.—Trees or erect shrubs with simple leaves.
 - A. Fruit capsular.
 - 1. Leaves very rough 4. *Nyctanthes*.
 - 2. Leaves not rough 5. *Syringa*.
 - B. Fruit drupaceous.
 - 1. Flowers in axillary panicles (also terminal in *O. glandulifera*).
 - (a) Petals free or connate in pairs... .. 6. *Linociera*.
 - (b) Corolla gamopetalous 7. *Olea*.
 - 2. Flowers in terminal panicles 8. *Ligustrum*.
 - 3. Flowers in axillary fascicles 9. *Osmanthus*.

1. FRAXINUS, Linn. (The Ashes.)

Deciduous trees. Leaves opposite, imparipinnate, rarely simple. Flowers small, polygamous or dioecious, in lateral or terminal panicles or racemes; bracts caducous. Calyx small; 4-toothed or 0. Corolla 0 or of 4, rarely 2 or 5, petals which are often united in pairs by the stamens. Stamens 2, attached near the base of the petals or sub-hypogynous. Ovary usually 2-celled; ovules 2 in each cell; style bifid. Fruit a winged nut, 1-seeded, winged at the top.

- Flowers in panicles on the current year's shoots.
 - Leaves 7—13 inches long 1. *micrantha*.
- Flowers in dense clusters on the previous year's shoots.
 - Leaves 3—6 inches long 2. *xanthoxyloides*.

1. *Fraxinus micrantha*, Lingelsh. Vern. Angu. Gen. Angār, NG. Anwān, A.—A large deciduous tree up to 8 feet girth and 100 feet high. Bark pale brown or pale grey, fairly smooth. Blaze .5 inch, crisp, pale yellow mottled with orange-brown the whole turning pinkish-brown on exposure. Young parts and inflorescence puberulous. Buds enclosed within several pairs of large obovate caducous scales more or less densely clothed with tawny tomentum. Leaves 7—13 inches long. Leaflets 5—9, the terminal one 4—6 by 1.5—2.5 inches, the lateral ones rather smaller, oblong or sometimes elliptic, caudate-acuminate, base cuneate, serrate, hairy along the sides of the main nerves beneath otherwise glabrous when mature, lateral nerves 10—13 pairs. Stalk of terminal leaflet .3—1 inch long. Petiolules of the lateral 0—3 inch long. Flowers in terminal drooping panicles, the lower branches axillary, appearing on the new shoots with the young leaves. Pedicels clustered, filiform, .1—4 inch long. Calyx .05 inch long, cupshaped, 4-toothed or teeth irregular. Petals 0. Anthers purplish, .1 inch long or more. Connective produced in a short horn. Filaments as long as or shorter than the anthers. Ovary dotted with blackish scales. Fruit .8—1.6 inches long by .2 inch broad; wing-tip emarginate.

Occurs throughout the hills between 5,500 and 8,000 feet. Fairly common, usually in oak forests. The leaves often turn purplish-brown some time before falling. Flowers: March-April. Fruit: July—September, but sometimes remaining on the tree till March.

There is no evidence among the specimens at Dehra Dūn or, I think, at Kew that *F. floribunda*, Wall. is found within our area though there are few flowering specimens available for examination. In *F. floribunda* petals are present and are about .1 inch long, the leaves also are apparently always quite glabrous beneath.

2. *Fraxinus xanthoxyloides*, Wall. Vern. Rēgcha, Bhotia.—A small deciduous tree. Bark pale grey or whitish with reticulate cracks. Blaze pale yellowish-brown. Branches stiff. Twigs greenish, smooth, lenticellate. Leaves 3—6 inches long, rachis very narrowly margined. Leaflets 7—9, the terminal sometimes wanting, .5—2 inches long, variable in shape, usually ovate-lanceolate or ovate-oblong, crenate-serrate, glabrous or slightly hairy along the midrib beneath, sessile or the lower narrowed into a short marginate petiolule .2 inch long or less. Flowers appearing before or with the young leaves on the shoots of the previous year, in dense clusters in the axils of the fallen leaves; clusters surrounded by dark brown scurfy bracts. Petals 0. Fruit 1.5—2 inches long by .3—35 inch broad, oblong-oblancheolate; wing-tip obtuse, emarginate or subacute.

Occurs along the Dhauli valley in North Garhwal between 8,000 and 11,000 feet. Here it is common on bare southern aspects and is often associated with *Juniperus macrospora*. It is much browsed and tends to become a dense mass of stiff interwoven branches bearing foliage much reduced in size. Flowers: May.

2. SCHREBERA, *Roxb.*

Trees. Leaves opposite, imparipinnate. Flowers in terminal 2-3-chotomous compound cymes. Calyx campanulate, truncate or unequally 4—7-toothed. Corolla salver-shaped; lobes 4—7, imbricate in bud. Stamens near the top of the tube. Ovules 3-4 in each cell; stigma shortly bifid. Fruit a woody obovoid, loculicidally 2-valved capsule.

Schrebera swietenoides, *Roxb.* Vern. *Banda*, R.—A medium-sized deciduous tree up to 7 feet girth and 65 feet high. Bark pale brown or dark grey, slightly rough, exfoliating in small irregular woody scales. Blaze .25—.5 inch, rather hard, not fibrous, pale yellow thickly mottled with orange, the whole rapidly turning reddish-brown on exposure. Twigs stout, lenticellate. Young shoots pubescent. Leaf-rachis 5—9 inches long. Leaflets 5—9, opposite, 3—7 by 1—3 inches, ovate or sometimes oblong, acuminate, entire, base acute or obtusely cuneate, softly pubescent on both surfaces, the middle pairs of leaflets usually the largest. Stalk of terminal leaflet .5—1.2 inches long. Petiolules of the lateral .3—.6 inch long. Flowers .5-.6 inch diameter, whitish, fragrant, closely covered with brown scales, in lax, terminal, pubescent, subcorymbose, trichotomous cymes 4—6 inches across. Corolla-tube .35—.5 inch long. Capsule 1.5—2 inches long, pyriform, pendulous, woody, brown dotted all over with raised specks.

Occurs in *sal* forests of the Ramnagar and Kalagarh Divisions up to 2,500 feet. Not common. Flowers: May-June with the new leaves. Fruit: March.

3. JASMINUM, *Linn.* (*The Jessamines.*)

Erect or climbing shrubs. Leaves opposite, rarely alternate, simple trifoliolate, or imparipinnate. Flowers in cymes, rarely solitary. Calyx-tube funnel-shaped or campanulate, 4—9-toothed or truncate. Corolla salver-shaped; tube narrow; lobes 4—10, imbricate in bud. Stamens included; connective usually produced. Ovules usually 2 in each cell; style filiform; stigma usually bifid. Fruit a didymous berry or simple by the suppression of one carpel. Seed 1, rarely 2, in each carpel.

I.—Leaves opposite. Flowers white or tinged with pink.

A. Leaves simple.

1. Cymes lax. Mature leaves glabrous beneath. Calyx-teeth .2 inch long or less.

(a) Corolla-tube .4-.5 inch long. Leaves without hairy glands 1. *arborescens*.

(b) Corolla-tube .7—1.2 inches long. Leaves with hairy glands in nerve-axils beneath ... 2. *glandulosum*.

2. Cymes dense. Mature leaves pubescent beneath. Calyx-teeth .2—.6 inch long ... 3. *pubescens*,

B. Leaves imparipinnate.

1. Calyx-teeth less than .05 inch long. Young leaves glabrous except for tufts of hair in the basal nerve-axils ... 4. *dispermum*.
2. Calyx-teeth .2 inch long or more. Young leaves puberulous.
 - (a) Axillary cymes shorter than the leaves. Leaflets 3—7. Calyx puberulous ... 5. *officinale*.
 - (b) Axillary cymes usually longer, often much longer than the leaves. Leaflets 5—11. Calyx glabrous ... 6. *grandiflorum*.

II.—Leaves alternate. Flowers yellow ... 7. *humile*.

1. *Jasminum arborescens*, Roxb. Vern. *Kutmani-bel*, H. A deciduous climber with rambling or dextrorse stems up to 40 feet high and 5 inches diameter, the stems often forming angular bends. Bark pale brown, rough, rather deeply fissured, exfoliating in corky and fibrous pieces. Blaze .2—5 inch, fibrous, pale yellow with a few pale orange streaks. Young shoots and leaves softly pubescent. Leaves opposite, simple, 2.5-6 by 1.5—3 inches, ovate or oblong-ovate, acuminate, base rounded, ultimately glabrous and dull green on both surfaces. Petiole .3—9 inch long, jointed .1-.2 inch from the base and leaving the lower portion attached to the stem when the leaf falls. Flowers 1—1.5 inches diameter, white, fragrant, in lax trichotomous pubescent terminal and axillary cymes 1—4 inches long. Pedicels .2—5 inch long. Calyx hairy with linear or linear-subulate teeth .05—15 inch long, unequal. Corolla-tube .4-5 inch long with 6—12 linear lobes as long as or rather longer than the tube. Ripe carpel solitary, oblong, usually oblique, .5 inch long, black.

Occurs along the subhimalayan tract and in the outer ranges of hills up to 4,000 feet. Fairly common in sal and miscellaneous forests. Flowers: April-May. Fruit: July-August.

2. *Jasminum glandulosum*, Wall.—An evergreen shrub with sub-erect, procumbent or subscandent stems up to 1 inch diameter. Bark pale yellowish-brown, very rough, corky, with minute lenticels on the branches. Young shoots puberulous. Leaves opposite, simple, 2.5—5 by 1.5—2.5 inches, ovate or elliptic, acuminate usually caudate, base obtuse rounded or cordate, glabrous except for hairy glands in the axils of the secondary nerves beneath; lateral nerves 4—7 pairs, arching. Petiole .1-.2 inch long, articulate. Flowers 1.5—1.8 inches diameter, white, fragrant, in lax axillary and terminal 1—3-flowered trichotomous cymes. Pedicels .5—1 inch long, slender, puberulous, with 1—3 joints, each joint bearing a pair of linear bracts .1—3 inch long. Calyx

puberulous with triangular or linear teeth .05—.2 inch long. Corolla-tube .7—1.2 inches long, very slender, with linear lobes .5—1 inch long and .1—.15 inch broad. Carpels .6 inch long, ellipsoid.

Occurs throughout the central and inner ranges between 2,000 and 4,500 feet. Scarce. It is generally found on steep banks or rocks in moist places. Flowers: May-June.

3. *Jasminum pubescens*, Willd. Vern. *Chamēli*, Gen.—An ever-green dextrorse climber with stems up to 4 inches diameter and 25 feet high, the branches often densely interlaced. Bark pale brown, rough, with close reticulate cracks, corky. Blaze .25—.35 inch, pale yellow. Young shoots and leaves softly pubescent. Leaves opposite, simple, 1—3 by .7—1.75 inches, ovate, acute or acuminate, entire, base rounded or cordate, ultimately dark green and glabrate above, more or less pubescent beneath, especially on the nerves. Petiole .2—.4 inch long, densely tomentose, jointed .1 inch or less from the base and leaving the lower portion attached to the stem when the leaf falls. Flowers .6—1.75 inches diameter, white, fragrant, sessile or shortly pedicelled, in dense capitate cymes usually terminating short axillary branches, sometimes on 2-bracteate axillary peduncles. Calyx densely pubescent with 7—9 filiform teeth .2—.6 inch long. Corolla-tube .4—.8 inch long with 6—9 oblong-lanceolate lobes, shorter than the tube. Carpels 1-2, ellipsoid, .5-.6 inch long, black when ripe surrounded by the long hairy calyx-teeth.

Occurs throughout the area up to 3,000 feet. Common in the subhimalayan tract especially in hedges and open scrub forest. The flowers are dimorphic in size, the larger flowers being shortly pedicelled with long calyx-teeth, the smaller flowers sessile with short calyx-teeth. Flowers: January—April. Fruit: July-August.

4. *Jasminum disperrum*, Wall.—A climber with dextrorse stems up to 20 feet high and 1 inch diameter. Bark pale yellowish-brown, rough and rather corky. Twigs glabrous, obscurely quadrangular. Leaves opposite, imparipinnate or the upper unifoliate, 2—5 inches long. Leaflets usually 3—5, rarely 7; the terminal 2.5—4 by .75—1.75 inches, lanceolate or ovate-lanceolate, entire, base cordate or rounded, 3—5-nerved, apex long-acuminate; the lateral ones half to one-third the size of the terminal; all glabrous except for tufts of hair in the axils of the basal nerves beneath, dull green with deeply impressed nerves above which are prominent and usually tinged with purple beneath. Petiolules 0—.15 inch long. Flowers .6—.8 inch diameter, white or tinged with pink, in many-flowered axillary cymes and terminal drooping panicles. Bracts .1 inch long or less, linear. Pedicels .1-.2 inch long. Calyx glabrous with teeth less than .05 inch long. Corolla-tube .5-.6

inch long with 5 ovate lobes shorter than the tube. Carpels 2, .3-.4 inch long, ellipsoid, dark purple when ripe.

Occurs throughout the hills between 4,000 and 7,000 feet. Fairly common in open scrub forest. Flowers: April.

5. *Jasminum officinale*, Linn. Vern. *Jai*, Gen.—A deciduous climber with dextrorse stems up to 20 feet high and 1.5 inches diameter. Bark pale yellowish-brown, rough, rather deeply and closely furrowed, corky. Blaze .1-.2 inch, not fibrous, white or pale yellow with scattered orange-coloured specks of harder tissue. Twigs striate. Leaves opposite, imparipinnate, 2-4 inches long; petiole and rachis narrowly margined. Leaflets 3-7; the terminal 1-3 by .4-1 inch, ovate or lanceolate, acuminate; the lateral usually one-half to one-third the size of the terminal, sessile or shortly petiolulate, the distal pair sometimes with broad connate bases; all puberulous when young, glabrous or nearly so when mature. Flowers .7-1 inch diameter, white often tinged with pink outside, in terminal few-flowered corymbs or cymes and axillary pedunculate few-flowered cymes shorter than the leaves, or the cymes often reduced to a single flower. Pedicels of the cyme flowers .3-.7 inch long. Calyx puberulous, with 5 linear teeth .2-.6 inch long. Corolla-tube .5-.7 inch long with 5 ovate or elliptic lobes. Carpels 2, .25-.4 inch long, ellipsoid, shining, black, containing one seed surrounded by juicy purple pulp.

Occurs throughout the hills between 6,000 and 9,000 feet. Common in oak forest, also in scrub forests near cultivation. Flowers: May-June. Fruit: November.

6. *Jasminum grandiflorum*, Linn.—A suberect shrub with arching branches forming a dense bush or the branches scrambling over shrubs and trees and reaching 20 feet high and 2 inches diameter. Bark pale brown, rough, exfoliating in soft fibrous strips. Blaze .1 inch, very fibrous, pale yellow. Twigs striate. Leaves opposite, imparipinnate, 2.5-5 inches long, petiole and rachis narrowly winged. Leaflets 5-11, usually 7-9; the terminal 1.2-5 by .4-.7 inch, rhomboid-ovate or lanceolate, acuminate or sometimes acute; the lateral usually two-thirds to one-half the size of the terminal, ovate, usually obtuse, mucronate, the distal pair usually with broad connate bases often confluent with the terminal, the proximal pair shortly petiolulate, the intermediate sessile; all puberulous when young, dull green above. Flowers .9-1.5 inches diameter, white often tinged with pink outside, fragrant, in lax axillary and terminal cymes longer than the leaves. Pedicels .5-1 inch long. Calyx glabrous with 5 linear teeth .2-.35 inch long. Corolla-tube .6-1 inch long with 5 elliptic or obovate lobes. Carpels 2.

Occurs in the central and outer hills between 2,000 and 5,000 feet. Generally scarce. I have found it growing as a rule on steep ground in open scrub forests. Flowers: July-November.

7. *Jasminum humile*, Linn.—An erect deciduous glabrous shrub usually 3—6 feet high, but stems attain 15 feet high and 4 inches diameter. Bark pale brown, fairly smooth, somewhat corky. Blaze 1—2·5 inch, not fibrous, white usually tinged with chlorophyl. Branches green, angular. Leaves alternate, imparipinnate, 2·5-6 inches long, rachis and petiole with a narrow but distinct thick wing on either side. Leaflets usually 5—7, rarely 3 or 9, variable in size; the terminal usually 1—3 by 1—1·2 inches, elliptic or lanceolate, acute; the lateral sessile or nearly so, decreasing in size downwards, usually broader and with obtuse or rounded tip; all rather thick, dull dark green above, pale beneath, midrib depressed above and prominent beneath, lateral nerves indistinct. Flowers 1—1·5 inch diameter, yellow, in terminal corymbose panicles. Bracts linear. Pedicels 1—1·5 inch long. Calyx with 5 very short teeth. Corolla-tube 1—1·5 inch long with 5 broadly-ovate lobes. Carpels 1-2, 1—1·5 inch long, ellipsoid, shining, black, containing 1-2 flattened brown seeds embedded in juicy purple pulp.

Occurs throughout the hills between 5,000 and 10,000 feet. Common in open forests, often in secondary growth. From the sheets at Dehra Dun it appears that forms with 2 leaflets are common in the drier Punjab hills. Flowers: May-June. Fruit: September—November.

4. NYCTANTHES, Linn.

Shrubs or small trees. Leaves opposite, simple, entire or toothed. Flowers in small bracteate heads disposed in terminal trichotomous cymes. Calyx ovoid-cylindric, sub-truncate, finally splitting or deciduous. Corolla salver-shaped; tube cylindric; lobes 4—8, contorted in bud. Stamens inserted near the top of the corolla-tube. Ovule 1 in each cell; stigma shortly bifid. Fruit an orbicular compressed capsule, separating into 2 valves.

Nyctanthes Arbor-tristis, Linn. Vern. *Kūri*, G. *Har-singār*, R and H.—A deciduous shrub or small tree up to 3·5 feet girth and 20 feet high. Bark brown, roughish. Blaze 2·5—3·5 inch, not fibrous, pale yellow or orange finely and closely mottled darker, the whole turning orange-brown on exposure. Twigs quadrangular, scabrous. Leaves 3—6 by 1·5—3·5 inches, ovate, acute or acuminate, very rough and scabrid above, roughly pubescent beneath, entire or with a few coarse teeth, base truncate rounded or cuneate. Petiole 2—4 inch long, stout, channelled above, hairy. Flowers 1—1·5 inch diameter, white with an orange-coloured tube, fragrant, in pedunculate bracteate heads disposed in axillary and terminal trichotomous cymes. Peduncles quadrangular, hairy. Corolla 3—5 inch long, glabrous. Capsule 1·5—2 inch long, ovate, truncated, strongly compressed, brown, leathery.

Occurs throughout the area up to 4,500 feet. Very common in dry miscellaneous forests and often gregarious on hot south aspects. Flowers: August—October. Fruit: February-March.

5. SYRINGA, *Linn.*

Shrubs. Leaves opposite, entire or pinnatifid. Flowers in terminal trichotomous panicles. Calyx campanulate, 4-toothed or sub-truncate. Corolla salver-shaped; tube longer than the calyx; limb 4-lobed, lobes valvate. Ovules 2 in each cell; stigma bifid. Fruit a coriaceous capsule, loculicidally 2-valved.

Syringa Emodi, *Wall.*—A large deciduous shrub up to 20 feet high and stems up to 4 inches diameter, glabrous or the young shoots and inflorescence slightly pubescent. Bark pale brown, fairly smooth, with conspicuous scattered pale circular lenticels. Blaze .25 inch, not fibrous, white or pale yellow. Young shoots, petioles and sometimes the midrib purplish-red or pink. Leaves 3—8 by 1.5—4 inches, elliptic-oblong, acute at both ends, thin, membranous, entire, pale dull green above, very pale beneath. Petiole .4—1 inch long. Flowers .3 inch diameter, white, fragrant, in terminal pyramidal panicles 4—8 inches long, the lower branches usually axillary. Corolla-tube .25—.35 inch long, slightly widening upwards; lobes oblong, hooded at the tips. Capsule .4—.7 inch long, cylindric, brown. Seed linear-oblong, narrowly winged all round.

Occurs throughout the central and inner ranges between 9,000 and 11,000 feet. Fairly common in open forest, often among secondary growth. Flowers: May—July. Fruit: October–November.

6. LINOCIERA, *Swartz.*

Shrubs or trees. Leaves opposite, entire. Flowers in cymes or panicles, sometimes in pedunculate clusters. Calyx small, 4-lobed. Corolla of 4 petals, nearly free or connate in pairs, induplicate-valvate in bud. Stamens attached at the base of the petals. Ovules 2 in each cell; style short; stigma bifid or entire. Fruit a drupe, usually 1-seeded.

Linociera intermedia, *Wight.*—A small evergreen glabrous tree. Bark dark brown, smooth or slightly rough. Blaze .3—.35 inch, hard, orange-yellow mottled darker. Leaves 4—8 by 1.5—3 inches, elliptic-oblong, acute or acuminate, base narrowed into and decurrent on the petiole, entire; lateral nerves 8—12 pairs with others between, fine, looped and reticulate within the margin. Petiole .5—1 inch long. Flowers .15 inch long, white, in axillary or extra-axillary panicles 1.2–5 inches long. Pedicels .05 inch long. Drupe .4—6 inch long, oblong, obtuse, bluish-purple with glaucous bloom.

Occurs along the subhimalayan tract up to 1,500 feet. It is undoubtedly scarce and has so far only been recorded from the Haldwani and Kalagarh Divisions where it is usually found on the banks of streams or in ravines. It is probably var. *Roxburghii*, F. B. I. Flowers: May–June, or perhaps February.

7. OLEA, *Linn.*

Shrubs or trees. Leaves opposite, entire or toothed. Flowers small hermaphrodite dioecious or polygamous, in panicles. Calyx small, 4-lobed. Corolla rotate or campanulate; lobes 4, valvate, often induplicate. Stamens inserted on the corolla-tube or subhypogynous. Ovules 2 in each cell; style short; stigma capitate or bifid. Fruit a drupe, usually 1-seeded.

Leaves densely scaly beneath, not glandular in the nerve-axils. Inflorescence axillary ... 1. *cuspidata*.

Leaves glabrous, nerve-axils glandular. Inflorescence terminal or axillary. ... 2. *glandulifera*.

1. *Olea cuspidata*, *Wall.* Vern. *Bair-banj.* NG. *Kaphlainj*, EA.—An evergreen shrub or small tree up to 3 feet girth and 25 feet high. Bark blackish, rough, exfoliating in small irregular strips. Blaze .3—·5 inch, rather hard, pale yellow with narrow orange streaks. Young shoots, petioles, and underside of leaves covered with pale coloured scales. Leaves 2—4 by .5—1 inch, oblong-lanceolate, entire, cuspidate, coriaceous, glossy dark green above, lateral nerves indistinct above indistinguishable beneath. Petiole .1—·5 inch long. Flowers .2—·25 inch diameter, whitish, bisexual, in axillary trichotomous panicles 1-2 inches long. Pedicels mostly 0. Corolla-tube short, lobes spreading. Drupe .3-4 inch long, ellipsoid, black with minute scattered pale specks.

Occurs along the main Himalayan range between 2,500 and 5,500 feet. Scarce. It is sometimes found growing in crevices in precipitous rocks. Flowers: May-June. Fruit: October.

2. *Olea glandulifera*, *Wall.* Vern. *Gair*, G. *Garura*, A.—A medium-sized evergreen tree up to 10 feet girth and 90 feet high. Bark dark brown, rough, exfoliating in hard irregular woody scales. Blaze .35—·75 inch, very hard, pale yellow densely streaked and mottled with orange the whole rapidly turning reddish-brown. Twigs glabrous, lenticellate. Leaves 3—6 by 1.25—2.5 inches, lanceolate, ovate- or oblong-lanceolate, long-acuminate, entire, glabrous, shining on both surfaces, pale beneath; lateral nerves slender 10—15 pairs with other smaller ones between, easily visible on both surfaces and glandular in the axils beneath. Petiole .5—1 inch long. Flowers .25 inch diameter, creamy-white, bisexual, in terminal and axillary trichotomous panicles up to 4 inches long and broad. Pedicels 0—·2 inch long. Corolla-tube short; lobes spreading. Drupe .3—·5 inch long, oblique, ellipsoid, purplish-black when ripe.

Occurs throughout the area between 1,500 and 5,500 feet. Common along the banks of rivers and in shady ravines. Flowers: April-May. Fruit: February.

8. *LIGUSTRUM*, Linn.

Shrubs or trees; branchlets often lenticellate. Leaves opposite, entire. Flowers small, white, in terminal panicles. Calyx small, truncate or 4-toothed. Corolla funnel-shaped, tube short or long; lobes 4, induplicate-valvate. Ovules 2 in each cell; stigma subclavate, 2-lobed. Fruit a 1—3-seeded drupe.

- A. Young shoots and inflorescence glabrous. Flowers
 .3 inch diameter 1. *compactum*.
 B. Young shoots and inflorescence pubescent. Flowers
 .1 inch diameter.
 1. Panicles 3—6 inches long. Bracts foliaceous,
 up to 1 inch long. Drupe .2-.3 inch long ... 2. *nepalense*.
 2. Panicles 6—10 inches long. Bracts .05 inch
 long. Drupe .4-.5 inch long ... 3. *robustum*.

1. *Ligustrum compactum*, Hook. f. and T.—A small deciduous glabrous tree up to 3 feet girth and 30 feet high. Bark grey, smooth, with conspicuous small lenticels. Blaze .15—.35 inch, rather fibrous, pale yellow sometimes mottled with orange. Twigs with scattered lenticels. Leaves 3—6 by 1-2 inches, lanceolate or oblong-lanceolate, gradually acuminate, base broadly cuneate or rounded, subcoriaceous; lateral nerves 8—14 pairs joined within the margin by loops. Petiole .3—.5 inch long, channelled. Flowers .3 inch diameter, white, fragrant, in terminal pyramidal panicles 4—6 inches long with the lower branches axillary. Pedicels 0—.05 inch long. Corolla .15 inch long; tube .05 inch long. Drupe .2—.4 inch long, ovoid or ellipsoid, dull purplish-black when ripe, containing 1-2 dark brown seeds surrounded by whitish pulp.

Occurs throughout the hills between 5,000 and 8,000 feet. Fairly common, usually in open forest, and especially on limestone soils. Flowers: May-June. Fruit: October-January.

2. *Ligustrum nepalense*, Wall.—A shrub or small tree. Twigs closely lenticellate. Young shoots hairy. Leaves 1.5—3.5 by .5—1.2 inches, elliptic-oblong, acute or shortly acuminate, base cuneate, subcoriaceous, glabrous; lateral nerves indistinct, 4—8 pairs, joined within the margin by loops. Petiole .15—.5 inch. Flowers about .1 inch diameter, white, subsessile, in terminal pyramidal bracteate panicles 3—6 inches long with the lowest branches axillary. Bracts foliaceous, coriaceous, persistent, up to 1 inch long, lanceolate. Panicle-branches closely lenticellate and rather densely clothed with spreading hairs. Calyx cup-shaped, glabrous, obscurely toothed, less than .05 inch long. Corolla-tube equal to the calyx. Drupe .2-.3 inch long.

Occurs throughout the central and inner ranges between 3,000 and 8,000 feet. Scarce in Garhwal but fairly common in East Almora. According to the F. B. I. the fruit is globose, but the only herbarium specimen of fruit I have seen appears to have ovoid fruits. Flowers: May-June. Fruit: December.

3. **Ligustrum robustum**, *Blume*.—A small tree up to 30 feet high and 3 feet girth. Old stems deeply and irregularly fluted. Bark quite smooth, pale brown. Blaze .2—'.25 inch, not fibrous, pale yellow faintly stippled with pale brown. Twigs densely lenticellate. Young shoots pubescent. Leaves 2—4 by 1—1.5 inches, ovate-lanceolate or elliptic, usually narrowed at both ends, sometimes acuminate, glabrous; lateral nerves indistinct 5—8 pairs, with smaller ones between. Petiole .1-.2 inch long. Flowers about .1 inch diameter, white, racemed and clustered in spreading terminal pyramidal panicles 6—10 inches long with the lowest branches usually axillary. Panicle-branches lenticellate and densely pubescent. Bracts .05 inch long, subulate. Pedicels 0—.1 inch long. Calyx campanulate, glabrous, minutely 4-toothed, .05 inch long. Corolla-tube equal to the calyx or nearly so. Drupe .4-.5 inch long, narrowly oblong, often slightly oblique.

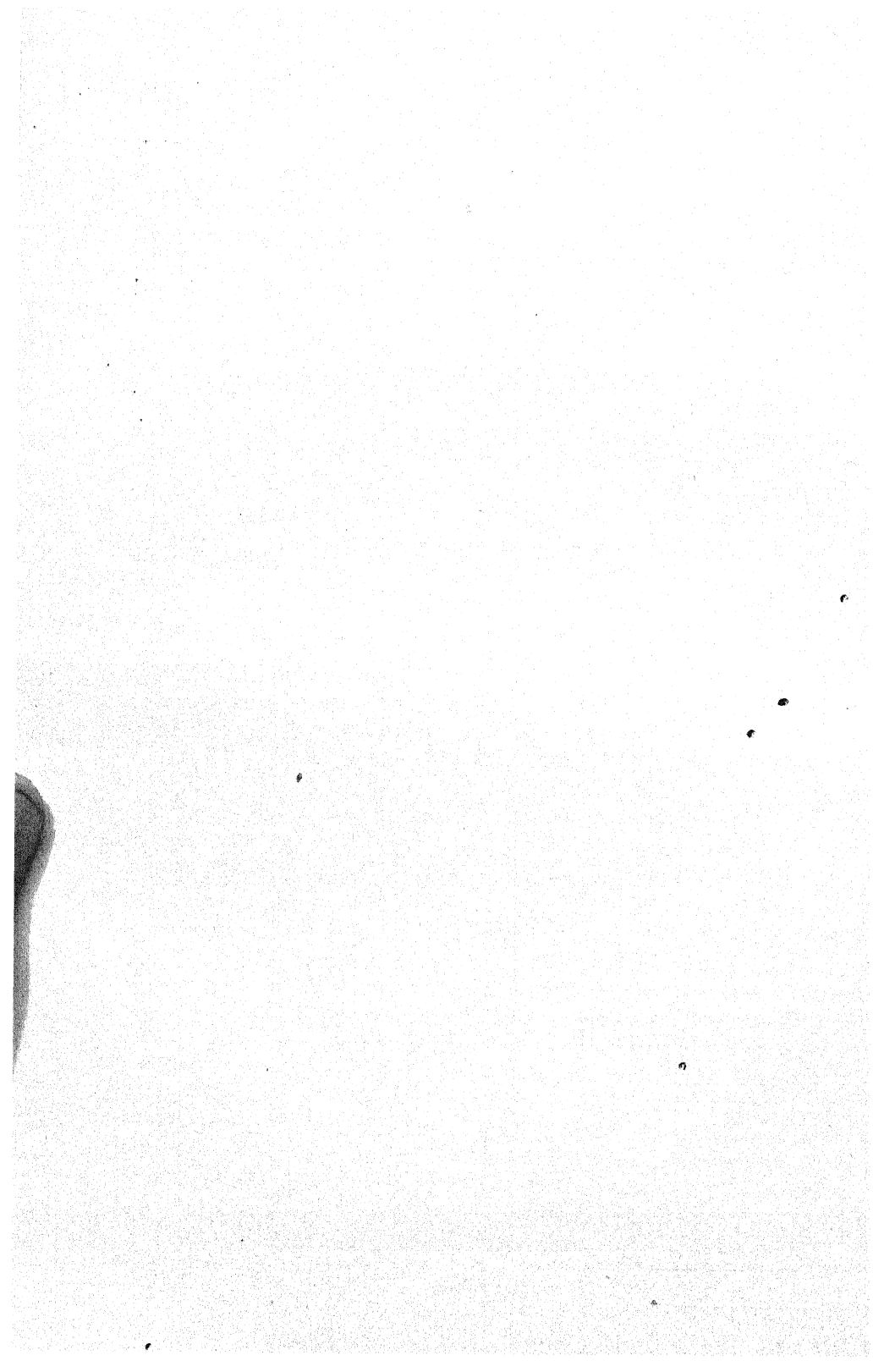
This species is found growing on the banks of perennial streams in the Guliapani Block towards the east of the Haldwani Division at about 9,000 feet elevation, but has not been recorded further west. Strachey and Winterbottom have also recorded it from the Sarju valley in Almora at 6,500 feet. Flowers: June-July.

9. OSMANTHUS, *Lour*.

Evergreen glabrous shrubs or trees. Leaves opposite. Flowers axillary and terminal, fascicled or in very short racemes, hermaphrodite or polygamous. Calyx 4-toothed or lobed. Corolla-tube short or long; lobes 4, obtuse, imbricate. Stamens subsessile; style bilobed or subentire; ovules 2 in each cell. Fruit an ovoid or globose drupe; endocarp bony or crustaceous.

Osmanthus fragrans, *Lour*. Vern. *Silang*, *Shilang* or *Silingi*, Gen.—A medium-sized tree up to 8 feet girth and 60 feet high with a dense spreading or rounded crown. Bark dark brown or blackish, fairly smooth with conspicuous scattered circular lenticels when young, rough and exfoliating in irregular woody scales when old. Blaze .5—.75 inch, hard, pale yellow or orange-brown finely mottled darker. Leaves 4—7 by 1.25—2 inches, oblong or lanceolate, shortly acuminate, entire, base acute, coriaceous, dull dark green above; lateral nerves about 8—16 pairs. Petiole .4—.6 inch long, channelled. Flowers .2—.25 inch diameter, yellow, heavily scented, in dense axillary fascicles. Pedicels .2—.5 inch long, slender. Corolla divided nearly to the base, lobes spreading. Drupe .7-.8 inch long, oblong, green with scattered pale spots when unripe, dark purple when ripe containing a single large elongate ribbed stone.

Occurs throughout the hills between 3,500 and 6,500 feet. Fairly common in shady moist ravines usually in oak forest. Brandis considered this tree was not indigenous to Kumaon, but in my opinion it is undoubtedly both wild and indigenous. Flowers: October. Fruit: April.



LVIII.—APOCYNACEÆ.

Trees or erect or climbing shrubs, rarely herbs. Leaves opposite or whorled, rarely alternate, simple, entire, exstipulate. Flowers regular, hermaphrodite, in cymes or panicles. Calyx inferior; lobes 5, rarely 4, imbricate, often with glands at the base within. Corolla usually rotate or salver-shaped; lobes 5, rarely 4, contorted and often twisted in bud. Stamens as many as and alternate with the corolla-lobes, inserted in the corolla-tube or on its mouth; anthers free or connivent in a cone and adherent to the stigma by the connective, cells sometimes spurred. Pollen granular. Disk often present, consisting of glands or annular or cupular. Ovary 2-celled (rarely 1-celled), or usually of 2 more or less distinct carpels united by the style; ovules 2-many in each cell, rarely solitary. Fruit of free or connate follicles, more rarely a berry or drupe. Seeds often with a coma of silky hairs or winged.

I.—Anthers not attached to the stigma.

A. Armed 1. *Carissa*.

B. Unarmed.

1. Leaves usually whorled. Flowers .3—·5 inch diameter.

(a) A tree. Leaves 4—9 in a whorl ... 2. *Alstonia*.(b) A shrub up to 2 feet high. Leaves opposite or 3-4 in a whorl ... 3. *Rauwolfia*.

2. Leaves opposite. Flowers .75—2 inches diameter.

(a) A tree. Leaves 5—10 inches long ... 4. *Holarrhena*.(b) A shrub. Leaves 3—6 inches long ... 5. *Tabernaemontana*.

II.—Anthers adhering to the stigma by a point on the connective.

A. Erect trees or shrubs.

1. Leaves opposite, more than 1 inch broad ... 6. *Wrightia*.2. Leaves usually ternate, less than 1 inch broad ... 7. *Nerium*.

B.—Climbers.

1. Leaves less than 3 inches broad.

(a) Anthers exserted. Corolla subrotate. Secondary leaf-nerves 5—9 pairs ... 8. *Vallisneria*.

(b) Anthers included. Corolla salver-shaped.

(i) Secondary nerves 4-5 pairs ... 9. *Ichnocarpus*.(ii) Secondary nerves 10—15 pairs ... 10. *Trachelospermum*.2. Leaves more than 3 inches broad ... 11. *Chonemorpha*.

1. *CARISSA*, Linn.

Much-branched spinous shrubs, erect or climbing. Leaves opposite, coriaceous. Flowers in trichotomous cymes. Calyx 5-lobed. Corolla salver-shaped; lobes 5, overlapping to the right. Stamens 5, included. Ovary 2-celled; ovules 1—4 in each cell; style filiform. Fruit a berry, 2- or by abortion 1-celled.

***Carissa opaca*, Stapf.** Syn. *C. spinarum* A. DC. (*non* Linn.). Vern. *Karaunda* or *Karunda*, Gen.—A rigid much-branched erect evergreen shrub with stems up to 15 feet high and 6 inches diameter, armed where the stem branches with opposite, straight or forked, stout thorns up to 2 inches long which arise from between the petioles. Bark pale yellowish-brown, roughish and thinly corky. Blaze .3 inch, crisp, not fibrous, pale yellow stippled with pale orange-brown. Young shoots pubescent. Leaves .5—2 by .25—1 inch, elliptic ovate or sub-orbicular, usually acute at both ends, apiculate, coriaceous, glossy green above, pale beneath, puberulous on the midrib on both sides, otherwise usually glabrous; lateral nerves indistinct, 2—4 pairs. Petiole .05—.15 inch long. Flowers about .4 inch diameter, white often tinged with pink, very sweet-scented, in pubescent terminal (rarely axillary) corymbose cymes up to 1 inch long. Pedicels .1 inch long. Corolla-tube .25—.35 inch long, slender. Berry .3—.4 inch long, ellipsoid, purplish-black, containing 2-3 shining black seeds surrounded by pink pulp and scanty milky juice.

Occurs throughout the area up to 4,000 feet. Very common in secondary-growth scrub forests. Flowers: April—June. Fruit: January—March.

2. *ALSTONIA*, R. Br.

Trees or shrubs, branches often in whorls. Leaves generally whorled; rarely opposite. Flowers in subterminal corymbose cymes. Calyx-tube short; lobes 5. Corolla salver-shaped; tube cylindric, dilated opposite the stamens. Stamens near the top of the tube, included. Disk annular or lobed or 0. Ovary of 2 distinct carpels; ovules many; style filiform. Fruit of 2 linear distinct follicles. Seeds with tufts of hair at each end.

***Alstonia scholaris*, Brown.** Vern. *Chatiün*, Gen.—A medium-sized evergreen tree up to 7 feet girth and 60 feet high with the branches in whorls. Stem usually more or less buttressed towards the base. Bark sometimes blackish sometimes pale ashy or almost white, slightly rough with shallow cracks and scattered lenticels. Blaze .35—.75 inch, hard, not fibrous, pale yellow mottled with orange, exuding a milky juice. Leaves 4—9 in a whorl, 4—9 by 1.25—2.5

inches, oblanceolate to obovate, obtuse acute or retuse, gradually narrowed into the petiole, glabrous, dark green above, pale beneath, with about 30—40 pairs of indistinct horizontal parallel secondary nerves. Petiole about .3—·6 inch long, with a green fleshy scale-like gland about .1 inch long at the base. Flowers .3—·5 inch diameter, greenish-white, in umbellately branched, pubescent, peduncled or sessile, terminal, cymose panicles 1·5—4 inches long; the flowers usually subcapitate at the ends of the stout branches. Calyx and corolla hairy. Follicles 12—24 inches long by .15 inch broad, pendulous.

Occurs throughout the subhimalayan tract and in the central and outer ranges of hills up to 2,000 feet. Generally scarce. Usually found on the banks of streams. At Bhalaon in the Ramnagar Division. I have measured a tree 14·5 feet girth and 60 feet high. Flowers: December—March. Fruit: May-June.

3. *RAUWOLFIA*, *Linn.*

Shrubs, usually glabrous. Leaves 3-4-nately whorled, rarely opposite. Flowers in corymbose or umbellate cymes. Calyx 5-lobed, eglandular. Corolla-tube dilated opposite the stamens, the throat usually hairy within; lobes usually 5, overlapping to the left. Stamens 5, included. Disk cup-shaped or annular. Ovary of 2 distinct or connate carpels; ovules 2 in each carpel; style filiform. Fruit of 2 connate or distinct drupes, usually 1-seeded.

***Rauwolfia serpentina*, Benth.**—A small glabrous shrub 1-2 feet high. Leaves opposite or 3-4 in a whorl, 3—7 by 1·2·5 inches, lanceolate elliptic-lanceolate or obovate, narrowed at both ends, membranous. Petiole .2—·7 inch long with small glands in the axils. Flowers .3 inch diameter, in terminal or axillary, peduncled, many-flowered cymes. Peduncles 1—4 inches long. Pedicels short, stout, red. Calyx .1 inch long, red. Corolla-tube slender, .5—·9 inch long, pink, with 5 spreading white lobes. Drupe .25—·5 inch diameter, shining, black when ripe.

This species has only been recorded from the Ramnagar Division and is probably rare within our area. Elsewhere it is found in *sal* forest. Flowers: May-June.

4. *HOLARRHENA*, *R. Br.*

Trees or shrubs. Leaves opposite. Flowers white, in corymbose cymes. Calyx 5-lobed, usually glandular within at the base. Corolla salver-shaped; tube cylindric; lobes overlapping to the right. Stamens near the base of the tube, included. Disk none. Ovary of 2 distinct carpels; ovules many; style short. Fruit of 2 long slender follicles. Seeds with deciduous coma.

Holarrhena antidysenterica, Wall. Vern. *Kura*, Gen. *Dudhi*, Gen. *Kwēra*, R.—A small deciduous tree up to 4 feet girth and 35 feet high. Bark somewhat rough. Blaze .4—·6 inch, not or very shortly fibrous, pale yellow closely mottled with pinkish- or orange-brown. Young shoots glabrous or pubescent. Leaves 5—10 by 2—4 inches, broadly ovate elliptic or elliptic-oblong, acute or acuminate, glabrous or pubescent; lateral nerves 10—16 pairs. Petiole 0—·2 inch long. Flowers white or creamy, .75—1·5 inches diameter, faintly scented, in many-flowered terminal sessile corymbose cymes 3—6 inches across. Corolla pubescent outside. Follicles distinct, 6—18 inches long by .2—·4 inch broad, pendulous, slightly curved, cylindric, often dotted with pale specks. Seeds .5 inch long, linear-oblong with pale brown coma .7—1·5 inches long.

Occurs in the subhimalayan tract and in the outer hill ranges up to 3,000 feet. Very common in secondary-growth scrub forests in the Bhabar and a common associate of *sal*. Flowers: May-June. Fruit: February-March.

5. **TABERNÆMONTANA**, Linn.

Trees or shrubs. Leaves opposite. Flowers white, in axillary and terminal cymes. Calyx 5-lobed or-partite, usually glandular within. Corolla salver-shaped. Stamens about the middle or below the middle of the tube. Disk none. Ovary of two distinct carpels; ovules usually many; stigma 2-lobed. Fruit of 2 ovoid or oblong follicles, coriaceous or fleshy, grooved on one face.

Tabernæmontana coronaria, Willd.—An evergreen glabrous shrub 5—10 feet high with stems up to 2 inches diameter. Bark pale brown or silvery-grey, smooth, with scattered circular lenticels. Blaze .1-·2 inch, not fibrous, cheesy, pale yellow. Leaves 3—6 by 1-2 inches, elliptic or elliptic-lanceolate, acuminate, narrowed towards the base, glossy green above, paler beneath, margin undulate; lateral nerves 6—8 pairs. Petiole .2—·4 inch long; axils glandular. Flowers 1-2 inches diameter, white, in solitary on paired 1—8-flowered sub-terminal cymes. Peduncles up to 2 inches long. Corolla-tube slender, .7—1 inch long. Follicles usually paired but sometimes single, 1-2 inches long by .4 inch wide, sessile or stipitate, glabrous, divaricate, 1—3-ribbed, yellowish-green outside, bright orange or red inside. Seeds 1—11, .3 inch long, dull blackish surrounded by a fleshy scarlet aril.

Occurs in an undoubtedly wild state in the subhimalayan tract where it is apparently indigenous though not very common. It is frequently cultivated in gardens and is found in a semi-wild condition throughout the hills up to 4,000 feet. It prefers shady moist situations. Flowers: May—November. Fruit: February.

6. *WRIGHTIA*, *R. Br.*

Shrubs or small trees. Leaves opposite. Flowers in cymes. Calyx short, 5-lobed, with glands or scales within. Corolla salver-shaped; tube usually short, cylindric, throat with 1-2 series of scales; lobes overlapping to the left. Stamens inserted on the mouth of the tube; anthers exserted, sagittate, adhering to the stigma, cells spurred at the base. Disk none. Ovary of 2 free or connate carpels; ovules many; style filiform. Fruit of 2 connate or distinct follicles, sometimes coherent at both ends. Seeds with deciduous coma.

***Wrightia tomentosa*, Rœm. and Schult.** Vern. *Darula* or *Dudhi*, Gen.—A small deciduous tree up to 6 feet girth and 40 feet high, or in the hills sometimes only a shrub. Stem often irregularly fluted at the base. Bark pale yellowish-brown, rather rough and corky, exfoliating in irregular small scales. Blaze .35—.7 inch, not or shortly fibrous, pale yellow faintly and closely mottled with pale orange, exuding a copious milky juice. Branches with numerous small prominent lenticels. Young shoots tomentose. Leaves 3—6 by 1.5—3 inches, elliptic, shortly caudate-acuminate, tomentose on both sides, base acute, margins undulate; lateral nerves 8—14 pairs, prominent and parallel. Petiole .1—.3 inch long, glandular in the axil. Flowers 1—1.4 inches across the spreading petals which are soon reflexed, in erect usually dense terminal cymes 2—4 inches across. Pedicels tomentose. Corolla waxy, pale greenish-yellow sometimes tinged with pink; tube .25 inch long. Corona-scales salmon coloured. Follicles united into a cylindric pendulous fruit 4—12 by .4—.6 inch, grooved at the junction of the carpels, straight, greenish speckled with pale tubercles.

Occurs throughout the area up to 4,500 feet. Fairly common in open dry miscellaneous forests. Flowers: May-June. Fruit: March.

7. *NERIUM*, *Linn.*

Glabrous shrubs. Leaves 3-4-nately whorled, rarely opposite, narrow, coriaceous. Flowers large, in racemose cymes. Calyx 5-partite, glandular within. Corolla salver-shaped; tube narrow with 5 broad scales in the throat; lobes overlapping to the right but twisted to the left. Stamens at the top of the tube, included; anthers sagittate, adhering to the stigma, cells spurred. Disk none. Ovary of 2 distinct carpels; ovules many; stigma with a basal tubercled membrane. Fruit of 2 long straight follicles. Seeds with terminal coma.

***Nerium odorum*, Soland.** Vern. *Kanpūri*, RK. *Kanur*, Gen. Eng. Oleander.—A glabrous evergreen shrub with rod-like branches.

Leaves ternate, sometimes opposite, 4—6 by .3—.9 inch, linear-lanceolate, narrowed at both ends, thick, coriaceous, midrib stout; lateral nerves very numerous, slender, at right-angles to the midrib. Petiole .2—.3 inch long, thick. Flowers 1.1—1.5 inches diameter, red pink or white, fragrant, in terminal cymes. Corolla-tube .7 inch long, lower half cylindric hairy within, throat narrow funnel-shaped. Corona of 5 scales in the throat of the corolla, each scale cleft into 3—7 linear segments. Follicles united at first ultimately separating, 5—8 by .3 inch, erect, straight. Seeds .2 inch long, densely villous, tipped with a coma of brown hairs .5 inch long.

Often planted in gardens but apparently also wild as for instance in the Mandalti valley of the Kalagarh Division. When wild it is found in stream-beds and along their banks at elevations up to 4,000 feet. Flowers: April—June.

8. VALLARIS, *Burm.*

Twining shrubs, rarely trees. Leaves opposite, minutely dotted. Flowers white, in lateral or subterminal cymes or fascicles. Calyx 5-partite, glandular or not within. Corolla salver-shaped, throat naked; lobes overlapping to the right. Stamens inserted at the top of the tube; anthers exserted, adhering to the stigma; cells spurred; connective with a large dorsal gland. Disk various. Ovary of 2 connate carpels; ovules many; style filiform. Fruit of 2 connate follicles. Seeds with long coma.

Vallisneria Heynei, *Spreng.* Vern. *Dudhi-bel* or *Dudhli*, Gen.—

An evergreen dextrorse climber with stems up to 5 inches diameter and 50 feet high, the branches often forming dense tangled masses. Bark pale yellowish-brown, rather deeply fissured, more or less corky. Blaze .25—.35 inch, white or pale yellow mottled or banded with pale orange sclerotic tissue, exuding a copious milky juice. Twigs very pale with numerous minute raised lenticels. Leaves 2—4 by 1.1—1.7 inches, elliptic-or oblong-lanceolate, acuminate, glabrous or nearly so, base acute, margin undulate, dull green above; lateral nerves 5—9 pairs. Petioles .3—.5 inch long, with bract-like glands in the axils. Flowers .6—.9 inch diameter, white tinged with green, fragrant, in 3—10-flowered lax axillary subcorymbose cymes 2.3 inches across. Peduncle and pedicels pubescent. Corolla-tube 1—1.5 inch long. Follicles 4—6 by 1.1—1.5 inches, straight, tapering to a point from above the middle. Seeds .5 inch long, ovoid; coma .7 inch long.

Occurs throughout the area up to 3,000 feet. Very common in dry miscellaneous forests of the Bhabar, also frequently associated with *khair*. Flowers: February—May. Fruit: April of the following year.

9. ICHNOCARPUS, *R. Br.*

Climbing shrubs. Leaves opposite. Flowers small, in lax panicle cymes. Calyx 5-lobed, glandular or not within. Corolla salver-shaped, throat contracted or villous; lobes overlapping to the right, upper half deflexed in bud. Stamens at or below the middle of the tube; anthers sagittate, adhering to the stigma, spurred at base. Disk free, 5-lobed. Ovary of 2 distinct carpels; ovules many; style short. Fruit of 2 slender, spreading or divaricate, follicles. Seeds with deciduous coma.

Ichnocarpus frutescens*, *R. Br. Vern. *Bel-kamu*, SG and R.—

An evergreen climber with dextrorse stems up to 2 inches diameter and 70 feet high, the branches often forming tangled masses over the tops of small trees. Bark slightly rough, reddish-brown, with numerous small circular raised lenticels. Blaze .2—4 inch, shortly fibrous, pink, exuding a copious creamy yellow juice. Young shoots rusty-pubescent. Leaves 1.5—4 by .7—2 inches, elliptic, acute, base acute or rounded, glabrous and dark green above, sparsely adpressed-hairy and pale with darker fine reticulate venation beneath; lateral nerves 4-5 pairs, arching. Petiole .1—2.5 inch long, puberulous. Flowers .3 inch diameter, white, scented, in many-flowered axillary and terminal narrow panicles. Peduncle and pedicels rusty-pubescent. Corolla-tube .1 inch long with narrow twisted bearded lobes. Follicles solitary or twin, 4—6 by .1-.2 inch, divaricate, straight or curved, rusty-pubescent when young. Seeds .5—7 inch long with scanty coma.

Occurs throughout the area up to 4,000 feet. Very common in open dry miscellaneous forests and a fairly common associate of *sal.* Flowers: August—December.

10. TRACHELOSPERMUM, *Lemaire.*

Climbing shrubs. Leaves opposite. Flowers in lax cymes. Calyx small, 5-partite, glandular or scaly within. Corolla salver-shaped; tube dilated round the anthers; lobes 5, oblique, overlapping to the right, twisted to the left. Stamens attached above the middle of the tube; anthers adhering to the stigma, cells spurred. Disk various. Ovary of 2 distinct carpels; ovules many; style cupular; stigma oblong. Fruit of 2 slender incurved follicles. Seeds crowned with a tuft of long hairs.

Inflorescence 2—5 inches long. Peduncles 1.2-5 inches long 1. *fragrans*.

Inflorescence .5—1 inch long. Peduncles .1—3 inch long 2. *axillare*.

1. *Trachelospermum fragrans*, *Hook f.*—An evergreen climber with stems up to 6 inches diameter and 60 feet high, often covered with rough spinescent warty tubercles up to .75 inch long which sometimes

terminate in a leafy shoot or give rise to adventitious roots. Bark reddish-brown, roughish owing to the presence of numerous prominent circular lenticels. Blaze .25—.4 inch, white or pale yellow mottled with orange-brown, not fibrous, exuding copious milky juice which immediately separates into watery and creamy components. Twigs reddish-brown. Young shoots pubescent or brown-tomentose. Leaves 2.5—5 by .75—2 inches, elliptic-lanceolate, acuminate, glabrous and rather glossy dark green above, glabrous or pubescent and pale with a fine network of darker veins beneath; lateral nerves 10—15 pairs. Petiole .2—3 inch long, pubescent or brown-tomentose, glandular in the axils. Flowers .4—.7 inch diameter, fragrant in lax terminal or axillary trichotomous glabrous or pubescent pedunculate panicles 2—5 inches long. Peduncles 1.2—5 inches long. Corolla white with a greenish centre; tube .25—.4 inch long. Follicles 6—12 by .2 inch, cylindric, glabrous or pubescent.

Occurs throughout the hills between 2,000 and 6,000 feet. Common in shady moist localities, often creeping over the ground or on rocks. The description given above includes a tomentose form in which the inflorescence, follicles, and leaves beneath are hairy whereas in the typical plant these parts are glabrous. The tomentose forms are more often found creeping over the ground, the glabrous usually climbing up trees. Flowers: April—June.

2. *Trachelospermum axillare*, Hook. f.—A climber with twining stems up to 15 feet high and .5 inch diameter. Bark lenticellate. Young shoots glabrous. Leaves 3—5.5 by 1—1.75 inches, oblanceolate or elliptic-oblong, abruptly and shortly caudate-acuminate, base acute, rather coriaceous, glabrous, dark green and rather glossy above, pale with prominent venation beneath; lateral nerves 10—15 pairs. Petiole .1—3 inch long, channelled, glabrous. Flowers about .5 inch diameter, dull purple or red (?) in pedunculate axillary glabrous cymes .5—1 inch long. Peduncles .1—3 inch long. Corolla-tube .15 inch long. Follicles 6—8 by .5 inch, cylindric, tomentose.

This species has been collected in moist shady ravines above Ghandial in the Duda Toli Reserve at about 7,000 feet, and again in dense oak forest in the Nawali Reserve along the Mauna Gadh at about 7,500 feet. Both localities are in the North Garhwal Division. Flowers: July—September.

11. CHONEMORPHA, G. Don.

Stout climbing shrubs. Leaves opposite, large. Flowers large, white, in lax cymes. Calyx tubular, with a ring of glands at the base inside; lobes 5. Corolla salver-shaped, throat naked; lobes 5, overlapping to the right, twisted to the left. Stamens included; anthers sagittate, adhering to the stigma, cells spurred. Disk thick. Ovary of 2 distinct carpels; ovules many; style filiform. Fruit of 2 straight parallel follicles. Seeds with long coma.

Chonemorpha macrophylla, *G. Don.*—A dextrorse or rambling climber with stems up to 80 feet high and 3 inches diameter. Bark pale brown, fairly smooth, with darker raised lenticels. Blaze .25—.75 inch, with silky fibre in the outermost layers, white mottled or banded with orange, exuding a milky juice. Twigs reddish-brown, smooth, covered with numerous small raised darker lenticels. Young shoots pubescent. Leaves 6—15 by 5—10 inches elliptic broadly ovate or suborbicular, shortly and abruptly acuminate, base abruptly cuneate or sometimes rounded, rather dark green above, very pale beneath, pubescent on both surfaces or glabrescent above when mature; lateral nerves 8—12 pairs prominent beneath. Petiole 1.2—5 inches long, pubescent. Flowers 2—5 inches diameter, scented, in lax subterminal pedunculate pubescent cymes 6—9 inches long. Corolla white becoming yellow towards the centre; tube 1.2—2 inches long; petals obliquely obtuse, twisted. Follicles 9—12 by .75 inch, slightly divergent at the base, cylindric, glabrous, smooth, grooved down the inside.

Occurs throughout the area between 1,000 and 4,500 feet. Locally fairly common, usually in shady ravines. Flowers: June-July.

LIX.—ASCLEPIADACEÆ.

Herbs or shrubs, usually twining and nearly always with milky juice. Leaves opposite or whorled, rarely alternate, sometimes wanting, entire, exstipulate. Flowers hermaphrodite, regular, 5-merous, usually in axillary umbelliform cymes. Calyx inferior; lobes imbricate. Corolla-tube usually short, the tube or throat often with a corona of scales, processes or hairs; lobes imbricate, contorted or valvate. Stamens inserted at the base of the corolla, sometimes free, but more usually connate into a fleshy column investing the pistil except the top of the stigma and usually bearing dorsal processes collectively termed the staminal corona; anthers connate or free, adnate to the stigma and the tip often produced into a membrane appressed to or inflexed over the stigma; pollen in each cell united into 1 or 2 granular or waxy masses. Ovary of 2 distinct carpels; styles 2, short, united in the large stigma which is included between the anthers or produced beyond them into a simple or 2-fid column. Fruit of 2 (or 1 by suppression) follicles. Seeds usually margined and with a coma.

I.—Erect shrubs.

- | | | | |
|-----------------------------------|-----|-----|-------------------------|
| 1. Leafless or with minute leaves | ... | ... | 1. <i>Orthanthera</i> . |
| 2. Leaves large, thick and fleshy | ... | ... | 2. <i>Calotropis</i> . |

II.—Shrubs with slender creeping or trailing stems, not twining.

3. *Hoya*.

III.—Climbers with rambling and twining stems.

A. Nerves on underside of leaves narrowly winged 4. *Heterostemma*.

B. Nerves not winged.

1. Leaves with very numerous lateral nerves, united to form an intramarginal vein.

- | | | | |
|----------------------------------|-----|-----|-------------------------|
| (a) Leaves under 75 inch wide | ... | ... | 5. <i>Periploca</i> . |
| (b) Leaves more than 1 inch wide | ... | ... | 6. <i>Cryptolepis</i> . |

2. Leaves without very numerous lateral nerves.

(i) Anthers with a membranous appendage.

- (1) Pollen masses pendulous (or horizontal).

- | | | |
|------------------------------------|-----|------------------------|
| (a) Flowers .9—1.1 inches diameter | ... | 7. <i>Holostemma</i> . |
| (b) Flowers smaller. | | |

* Twigs with a line or band of hairs

. . . running down the internodes ... 8. *Cynanchum*.** Twigs uniformly tomentose ... 9. *Toxocarpus*.

- (2) Pollen masses erect (or horizontal).

- | | | |
|-------------------------------------|-----|----------------------|
| (a) Flowers 1.1-1.3 inches diameter | ... | 10. <i>Telosma</i> . |
| (b) Flowers smaller. | | |

- * Corolla rotate or cupshaped.
 - † Flowers .5—.8 inch diameter ... 11. *Dregea*.
 - †† Flowers smaller ... 12. *Tylophora*.
- ** Corolla campanulate.
 - † Corona obsolete ... 13. *Gongronema*.
 - †† Corona attached to the corolla ... 14. *Gymnema*.
 - ††† Corona attached to the staminal column ... 15. *Marsdenia*.
- (ii) Anthers without membranous appendages ... 16. *Leptadenia*.

ALTERNATIVE KEY.

1. Stems erect ... 2.
 - Stems procumbent, rambling or twining ... 3.
2. Leafless or with minute leaves ... 1. *Orthanthera*.
 - Leaves large thick and fleshy ... 2. *Calotropis*.
3. Shrubs with slender creeping or trailing stems ... 3. *Hoya*.
 - Climbers with rambling and twining stems ... 4.
4. Nerves on underside of leaves narrowly winged ... 4. *Heterostemma*.
 - Nerves not winged ... 5.
5. Leaves with very numerous lateral nerves,
 - united to form an intramarginal vein ... 6
 - Leaves without very numerous lateral nerves ... 7.
6. Leaves under .75 inch wide ... 5. *Periploca*.
 - Leaves more than 1 inch wide ... 6. *Cryptolepis*.
7. Petiole narrowly winged ... 7. *Holostemma*.
 - Petiole not winged ... 8.
8. Twigs and young shoots with a line or band of hairs running down the internodes ... 9.
 - Hairs on twigs and young shoots, if present, not forming a definite line or band ... 10.
9. Flowers yellowish-green ... 8. *Cynanchum*.
 - Flowers pale buff ... 14. *Gymnema*.
10. Flowers 1 inch diameter or more ... 10. *Telosma*.
 - Flowers less than 1 inch diameter ... 11.
11. Leaves not exceeding 3 inches long ... 16. *Leptadenia*.
 - Leaves exceeding 3 inches ... 12.
12. Petioles not exceeding .6 inch long ... 9. *Toxocarpus*.
 - Petioles mostly exceeding .6 inch ... 13.
13. Corolla rotate or cup-shaped ... 14.
 - Corolla campanulate ... 15.
14. Flowers .5—.8 inch diameter ... 11. *Dregea*.
 - Flowers smaller ... 12. *Tylophora*.
15. Follicles .2-.3 inch diameter ... 13. *Gongronema*.
 - Follicles .75 inch diameter or more ... 15. *Marsdenia*.

1. ORTHANTHERA, *Wt.*

An erect shrub. Leaves minute or wanting. Flowers small, crowded in cymes. Calyx 5-lobed, eglandular. Corolla salver-shaped.

Corona of 5 small erect scales inserted in the sinuses of the corolla lobes, sometimes with an inconspicuous fleshy ring below the anthers. Column ovoid; anther-tips without appendages. Stigma included. Fruit a solitary elongate follicle. Seeds comose.

***Orthanthera viminea*, Wight.**—A bushy shrub 4—8 feet high with stems up to 1·5 inches diameter. Bark smooth, pale ashy. Blaze ·05 inch, pale yellow, with whitish silky fibre in the outer layers. Twigs up to about ·2 inch diameter, smooth, terete, yellowish-green. Young shoots pubescent. Leaves often absent; when present, opposite, ·1 inch long, linear, pubescent. Flowers ·3 inch long, dull brown, in compact few-flowered cymes arranged singly at the nodes. Peduncle ·1·1 inch long, pubescent, sometimes forked at the top. Pedicels ·1 inch long, densely clothed with short, brown, silky hairs. Calyx ·2 inch long; lobes linear-oblong, slightly exceeding the corolla-tube, densely hairy without. Corolla villous without, glabrous within. Follicles erect, 2·7—4·5 by ·2 inch, straight, smooth. Seeds ·1—·15 inch long; coma ·7 inch long.

Occurs in open river-beds and on beds of shingle and sand bordering rivers probably throughout the subhimalayan tract and following up the main river beds into the central hill ranges. Flowers: February—April. This species is liable to be confused with *Leptadenia Spartium*, Wight. But in *L. Spartium* the leaves when present are 1·2 inches long and linear, whilst the follicles are reflexed in fruit instead of being erect. This species has not yet been recorded from our area.

2. CALOTROPIS, *R. Br.*

Erect shrubs or small trees. Leaves opposite, broad. Flowers in umbellate or racemose lateral pedunculate cymes. Calyx 5-lobed; lobes glandular within. Corolla broadly campanulate or subrotate; lobes valvate. Corolline corona 0. Staminal corona of 5 fleshy laterally compressed sculptured processes radiating from the staminal column; anther-tips membranous, inflexed. Stigma depressed, 5-angled or lobed. Fruit of 2 short thick follicles.

Corolla uniformly coloured, lobes spreading at first.	Buds	
ovoid ... ..	...	1. <i>gigantea</i> .
Corolla not uniformly coloured, lobes erect at first.	Buds	
much depressed ... ..	...	2. <i>procera</i> .

1. *Calotropis gigantea*, *R. Br.* Vern. *Ak* or *Ank*, Gen.—An erect evergreen shrub 5—10 feet high with stems up to 6 inches diameter. Bark pale yellowish-brown, rough and thickly corky with numerous deep cracks. Blaze ·2—·35 inch, pale yellow more or less tinged with chlorophyl, exuding copious milky juice. Young parts clothed with white cottony tomentum. Leaves 3·5—8 by 1·5—4 inches, subsessile, obovate-oblong or elliptic-oblong, apex rounded obtuse or acute, base cordate often amplexicaul, rather thick and fleshy, glabrous when mature. Buds ovoid, ·6—·7 inch long just before opening.

Flowers 1·5—1·75 inches diameter, reddish- or bluish-purple or rarely white, unscented, in umbellate cymes which are white-tomentose when young becoming nearly glabrous. Peduncles axillary, stout, up to 4 inches long. Corolla-lobes ovate-lanceolate, or oblong-lanceolate with obtuse tips, spreading at first then reflexed. Follicles 3·5-4·5 by 1·5 inches, obliquely ovoid, recurved at the base, smooth.

Occurs along the subhimalayan tract up to 3,000 feet. Usually found growing on open waste ground and is sometimes subgregarious. Flowers: December—July, but chiefly February—June.

2. *Calotropis procera*, R. Br. Vern. *Ak*, Gen.—An erect ever-green shrub 1—4 feet high, branching from or near the base with stems up to 1 inch diameter. Young parts clothed with white cottony tomentum. Leaves 3—7 by 2—5 inches, subsessile, broadly elliptic, oblong or obovate, apex abruptly acute or short acuminate, base cordate, glabrous when mature, dull green, rather thick and fleshy. Buds much depressed, 3·4 inch long by 6 inch across just before opening. Flowers 6—9 inch diameter, purplish-pink, unscented, in umbellate cymes which are white-tomentose when young becoming nearly glabrous. Peduncles axillary, stout, up to 4 inches long. Corolla-lobes ovate, acute, erect at first the tips ultimately curving outwards, purplish-pink above, pale greenish- or silvery-white tinged with pink outside; tube campanulate coloured similarly to the outside of the petals. Follicles 3-4 by 1·5 inches, recurved, somewhat oblong, smooth.

Occurs throughout the area up to 2,500 feet. On open waste ground and often on the flat banks of rivers. Flowers almost throughout the year but chiefly December—May.

3. HOYA, R. Br.

Twining pendulous or rarely erect often epiphytic shrubs. Leaves opposite, thick and fleshy or coriaceous. Flowers in umbels. Calyx small, 5-partite, with 5 glandular scales. Corolla rotate, fleshy or waxy; lobes valvate in bud. Corona staminal, of large fleshy or horny processes, stellately spreading or ascending, often concave on the upper surface, margins often recurved so as to enclose a hollow space, the inner angle often produced into a tooth or spur. Column short, anthers conniving over the stigma with tips membranous, rarely 0. Fruit of 2 or 1 follicles, usually slender with a thin pericarp. Seeds with long coma.

Leaves 1-2 inches long. Peduncle puberulous ... 1. *lanceolata*.

Leaves 2—5 inches long. Peduncle glabrous ... 2. *longifolia*.

1. *Hoya lanceolata*, Wall.—Stem stout, climbing. Branches long, pendulous. Twigs hairy. Leaves 1-2 inches long, lanceolate or rhomboid-lanceolate, fleshy, midrib very obscure, acuminate, base acute,

glabrous or puberulous only on the midrib above. Petiole .05—1 inch long, hairy. Flowers .5 inch diameter, white, in terminal and extra-axillary umbellate cymes. Peduncles and pedicels stout, puberulous. Corolla-lobes subtriangular, puberulous within. Corona of 5 fleshy, stellately spreading processes. Follicles 5-6 inches long, very slender.

There are no specimens of this plant from our area at Dehra Dun but there is one sheet in the Kew Herbarium collected by Strachey and Winterbottom at 3,500 feet elevation near Kapkot in the Almora District and it is also reported to occur in the Kota Dun. As regards habit I have copied out the remarks given in the F. B. I. Flowers: March.

2. *Hoya longifolia*, *Wall.*—A shrub with slender creeping and hanging scarcely woody stems about .1 inch diameter. Twigs glabrous or pubescent. Leaves 2—5 by .5—1 inch, narrowly lanceolate or oblanceolate, acuminate, dull green, thick and fleshy, nerves very obscure. Petiole .3—.5 inch long, stout. Flowers .6-.7 inch diameter, faintly scented, white, in extra-axillary umbellate cymes. Peduncle .5—2 inches long, stout, glabrous. Pedicels .9—1 inch long. Corolla-lobes subtriangular, as broad as long, glabrous or pubescent within, margins ciliate. Corona of 5 fleshy stellately spreading processes shining like polished ivory. Follicles solitary, 6—12 inches long by about .15 inch wide. Seeds minute; coma .5 inch long.

Occurs throughout the hills between 3,000 and 5,000 feet. Fairly common, usually on steep rocks to which the stems attach themselves by means of adventitious roots. Flowers: June—August.

4. *HETEROSTEMMA*, *W. and A.*

Twining undershrubs. Leaves opposite, a minute gland near the base on the upper surface. Flowers small, in axillary umbellate or racemose cymes. Calyx 5-partite, minutely glandular within. Corolla rotate; lobes broad, valvate. Corona of 5 spreading lobes, usually with an erect process on the upper side. Column small, depressed; anthers minute, ending in a small membranous appendage. Stigma 5-angled. Fruit of 2 slender follicles, often reflexed. Seeds with silky coma.

Heterostemma alatum, *Wight.*—A small climber with dextrorse stems up to 10 feet high and .5 inch diameter. Blaze with copious milky juice. Twigs green with two lines of hairs running down the internodes. Leaves 3—6 by 1.75—3.5 inches, ovate or elliptic-oblong, acute or with a short cusp, base cuneate or rounded, glabrous or puberulous on both surfaces, rather thick and fleshy, primary and secondary nerves indistinct above but distinct and narrowly winged beneath, lateral nerves 4—5 pairs the lowest 2 pairs basal or sub-basal, a few conical glands at the base of the midrib above, upper surface dark green and rather glossy, lower surface pale. Petiole 1-2 inches long. Flowers .5—.75 inch diameter,

yellow, in shortly pedunculate umbelliform extra-axillary cymes. Peduncles .1—·3 inch long, stout. Pedicels .25—.5 inch long. Coronal processes ovate-lanceolate, acuminate, with a large ovate acute concave appendage on the surfaces. Follicles 3-4 by .2-·3 inch, divaricate and even slightly reflexed, straight, pointed. Seeds .4-·5 inch long; coma 1—1.3 inches long.

Probably occurs throughout the central and outer hills between 3,000 and 6,000 feet, but it is scarce and we have only one specimen at Dehra Dun from our area collected near Sirkot in North Garhwal. Here I noticed that the plant sent up annual shoots from a short woody perennial basal portion and this is probably its usual habit. Flowers: July-August.

5. PERIPILOCA, Linn.

Glabrous twining or erect shrubs, sometimes leafless. Leaves opposite. Flowers in lax cymes. Calyx 5-partite with 5 glands within. Corolla rotate; lobes usually bearded within, overlapping to the right. Corona corolline, a ten-lobed ring, often produced behind the stamens into 5 subulate or branched processes. Stamens included; filaments free; anthers bearded on the back or at the base; conniving over and adhering to the stigma, tips cohering. Stigma convex. Fruit of 2 smooth cylindric follicles. Seeds comose.

Periploca calophylla, Falc.—A glabrous evergreen climber with dextrorse stems up to 25 feet high and 1.2 inches diameter, with profuse spreading branches. Bark dark reddish-brown, rough, with prominent small raised lenticels. Blaze .1-·2 inch, pale yellow or white exuding milky juice. Leaves 2—4 by .2—.7 inch, linear or lanceolate, caudate-acuminate, glossy above, rather thin, margin undulate, lateral nerves very slender and numerous united to form an intramarginal vein. Petiole .05—.15 inch long. Flowers .3 inch diameter, yellow or pinkish, in small axillary cymes .5 inch long. Pedicels slender. Corolla-tube very short; lobes ovate-oblong, more or less hairy within. Corona of 5 filiform hairy processes. Follicles 4—8 by .15 inch, straight or slightly curved, firm but not woody, parallel or divergent. Seeds linear, .5 inch long; coma 1—1.5 inches long.

Occurs throughout the hills between 3,000 and 6,000 feet. Generally scarce. In ravines and sometimes on rocks. Flowers: April-May.

6. CRYPTOLEPIS, R. Br.

Twining glabrous shrubs. Leaves opposite. Flowers in lax dichotomous cymes. Calyx deeply 5-fid with 5 scales within. Corolla-tube short; lobes overlapping and twisted to the right. Corona corolline, of 5 linear or clavate conniving scales at about the middle of the tube. Filaments subconnate at their broad bases; anthers with conniving acuminate tips. Stigma broadly conic. Fruit of 2 divaricate follicles. Seeds comose.

Cryptolepis Buchanani, *Rœm.*—Vern. *Dudhi-bel*, Gen.—A glabrous deciduous climber with dextrorse stems up to 60 feet high and 2 inches diameter. Bark dark purplish-brown or blackish peeling off laterally in thin papery pieces. Blaze .2—·35 inch, rather fibrous, pale yellow or orange, exuding a copious milky juice. Twigs with conspicuous lenticels. Leaves 3·5—7 by 1·25—3 inches, elliptic-oblong, apex usually abruptly short-acuminate, dark glossy green above, very pale almost whitish and glaucous beneath, coriaceous, with very numerous slender nearly horizontal secondary nerves united within the margin, base usually narrowed into the petiole. Petiole .2—·5 inch long. Flowers .5—·7 inch diameter, greenish-yellow, in lax axillary paniculate cymes .5—2 inches long. Pedicels .1 inch long. Corolla-tube .1 inch long; lobes linear or linear-lanceolate. Corona of 5 fleshy clavate scales. Follicles 2—4 by .5—·7 inch in the middle, gradually tapering to a point. Seeds .3 inch long, black; coma 1 inch long.

Occurs throughout the area up to 4,000 feet. Very common especially in dry miscellaneous forests. Flowers: May—July.

7. HOLOSTEMMA, *R. Br.*

Twining shrubs. Leaves opposite, cordate. Flowers large, purple, in few-flowered axillary cymes. Calyx 5-partite, eglandular. Corolla campanulate or subrotate; lobes thick overlapping to the right. Corona double; outer thick annular fleshy, sometimes 10-lobed; inner of 5 horny 2-winged processes at the back of the anthers, the wings of adjacent anthers sometimes contiguous. Anthers with membranous tips. Stigma 5-winged. Fruit of 1-2 thick broad follicles. Seeds comose.

Holostemma annulare, *K. Schum.*—A twining shrub. Branches glabrous, hollow; juice milky. Leaves 3—5 by 2-3 inches, ovate or triangular, deeply cordate with rounded basal lobes, acuminate, margins undulate, slightly puberulous on both surfaces especially along the nerves and with small conical glands at the base of the midrib above, basal nerves 5—7. Petiole 1-2 inches long, puberulous, narrowly winged. Flowers .9—1·1 inches diameter, purplish-crimson within, frosted-white or pinkish outside, fragrant, in lax usually umbelliform pedunculate extra-axillary cymes. Peduncles .5—1·5 inches long. Pedicels .5—1 inch long. Corolla campanulate; lobes ovate-oblong. Coronal ring .1 inch high. Anthers large with 10 large stiff horny processes on the backs decurrent to the base of the column as fleshy wings. Follicles 4-5 inches

long, oblong, tapering to a blunt point, smooth. Seeds .25 inch long, compressed; coma .7—1 inch long.

There is only one specimen from our area at Dehra Dun and this was collected by Duthie in the Sarju valley. It is also reported by Mr. H. G. Champion to occur in the Central Almora Division and it will almost certainly be found along the subhimalayan tract. Flowers: July—September.

8. CYNANCHUM, *Linn.*

Erect or twining herbs or shrubs. Leaves opposite, rarely whorled. Flowers small, in axillary umbellate or corymbose cymes. Calyx 5-partite, usually glandular within. Corolla rotate, lobes overlapping to the right or valvate. Corona adnate to the base of the column, 5-partite cupular or campanulate, variously toothed or lobed with or without scales or tubercles on the inner face. Filaments connate in a short column, anthers sessile or stipitate with membranous inflexed tip. Fruit of 2 smooth follicles, often winged. Seeds comose.

Leaves .5—2.25 inches broad. Peduncle .1—4 inch long 1. *Dalhousia*.

Leaves 2—5 inches broad. Peduncle 2—6 inches long ... 2. *auriculatum*.

1. **Cynanchum Dalhousiæ, Wight.**—A slender dextrorse climber with annual (sometimes perennial?) herbaceous stems up to 10 feet high and .2 inch diameter, with a line of hairs running down the internodes. Leaves 3—7 by .5—2.25 inches, oblong-lanceolate, deeply cordate with short rounded basal lobes and open sinus, narrowed to a long point, minutely pubescent above, glabrous or glabrescent and pale beneath; lateral nerves 4-5 pairs including the basal, conspicuous beneath, very oblique. Petiole .3—8 inch long, rather deeply channelled above. Flowers .4-.5 inch diameter, pale yellowish-green, in pedunculate umbelliform extra-axillary cymes. Peduncle .1—4 inch long, puberulous. Pedicels .2—4 inch long, slender, puberulous. Corona campanulate, erect, white, 5—10-toothed, with 5 small scales near the base within, nearly as long as the corolla. Follicles usually single, 3-4.5 by .6 inch, divaricate when there are two, glabrous, pointed. Seeds .3 inch long; coma nearly 1.5 inches long.

Occurs on the outer hill ranges between 5,000 and 6,500 feet. Not very common, usually in shady oak forest. Flowers: July-August. Fruit: April.

2. **Cynanchum auriculatum, Royle.**—A slender twining climber with stems up to 10 feet high and .25 inch diameter, herbaceous or perhaps sometimes woody, with a band of hairs running down the internodes. Leaves 3—6 by 2—5 inches, broadly ovate or ovate-lanceolate, base deeply cordate with broad rounded lobes, apex caudate-acuminate, margin often undulate, sparsely pubescent with short adpressed hairs above, puberulous on the nerves beneath, a few small conical glands at the base of the midrib above, basal nerves 5—7. Petiole 1—3 inches long. Flowers .3—5 inch diameter, yellowish-green, in many-flowered

long-peduncled extra-axillary cymes. Peduncle 2—6 inches long, stout, puberulous. Pedicels 3—8 inch long, slender, puberulous. Corona much shorter than the corolla, cup-shaped, deeply 5-lobed, lobes bearing 5 small scales on their inner faces. Follicles 3-4 by 4·5 inch, divaricate, pointed. Seed 35 inch long; coma 1 inch long.

Occurs along the slopes of the main Himalayan range between 7,000 and 8,500 feet. Flowers: June—August.

9. TOXOCARPUS, *W. and A. (ex parte.)*

Twining shrubs. Leaves opposite. Flowers in axillary dichotomous paniculate or racemose cymes. Calyx small, 5-lobed. Corolla-tube short, usually campanulate; lobes overlapping to the left. Corona of flattened scales attached to the staminal tube. Filaments connate; anthers minutely fimbriate at the tip. Stigma long and slender or clavate. Fruit of 2 divaricate follicles. Seeds comose.

Toxocarpus himalensis, *Falc.*—A small twining evergreen climber. Young shoots densely rusty-tomentose. Leaves 3—5 by 75—2 inches, elliptic or elliptic-oblong; shortly blunt-acuminate, base rounded subcordate or acute, densely rusty-tomentose on both sides when young, glabrous above when mature; lateral nerves 6—8 pairs, slender, arcuate. Petiole 3—6 inch long, densely rusty-tomentose when young. Flowers 4·5 inch diameter, in axillary rusty-pubescent dichotomous cymes about 1 inch long. Pedicels 1·2 inch long. Bracts 1 inch long, linear, pubescent. Calyx-lobes oblong, about 1 inch long, pubescent outside. Corolla-tube urceolate, as long as the calyx, white; lobes ligulate, villous at the base within, yellow. Follicles 4—6 by 4—6 inch across the middle, gradually tapering to a point, rusty-pubescent when young, ultimately glabrous. Seeds 5—7 inch long, lanceolate; coma 1—1·5 inches long.

Occurs on the central and outer hill ranges between 2,000 and 3,500 feet. It is found in damp and shady ravines but is scarce. Flowers: July.

10. TELOSMA, *Coville.*

Twining undershrubs. Leaves opposite, usually cordate. Flowers yellow or greenish, in axillary umbelliform cymes. Calyx 5-partite, minutely glandular within. Corolla salver-shaped, tube swollen below; lobes overlapping to the right. Corona staminal, processes adnate to the back of the anthers, erect, laterally or dorsally flattened, sometimes 2-lamellate, the inner lamella overlapping the membranous tip of the anther and the stigma. Column rather large. Stigma umbonate or capitate. Fruit of 1-2 lanceolate terete rather turgid follicles. Seeds comose.

Telosma pallida, Craib. Syn. *Pergularia pallida*, W. and A.—A slender dextrorse climber dying back annually to the ground or a few feet at the base persisting and attaining .35 inch diameter. Bark pale brown and somewhat corky. Blaze without milky juice. Leaves 1.5-4.5 by 1—1.75 inches, ovate, acuminate, base rounded truncate or cordate, more or less puberulous especially on the nerves or glabrous, a few minute conical glands at the base of the midrib above, membraneous, dull dark green above pale beneath. Petiole .5—1.5 inches long. Flowers 1—1.3 inches diameter, yellowish-green, unscented, in umbelliform extra-axillary cymes. Peduncle .2—6 inch long, pubescent. Pedicels .25—6 inch long, pubescent. Corolla-lobes linear-oblong, glabrous, twisted, glossy above. Corona of 5 erect membranous processes, each with a tongue-like prolongation from the inner face exceeding the stigma. Follicles usually solitary 2.5-4 by .7 inch, straight, smooth, tapering to a blunt point. Seed .4 inch long; coma 1 inch long.

Occurs throughout the area up to 5,000 feet. Rather scarce. Flowers: June-July.

11. DREGÆA, *E. Meyer*.

Twining shrubs. Leaves opposite. Flowers greenish in umbelliform cymes. Corolla rotate; lobes broad, overlapping to the right. Corona staminal, with fleshy spreading depressed lobes and a minute inner cusp incumbent on the anthers. Column very short, fleshy; anther-tips short, inflexed. Stigma conical or dome-shaped. Fruit of 1-2 thick hard follicles, often ribbed when dry.

Dregæa volubilis, Benth. Syn. *Marsdenia volubilis*, Cooke.—A deciduous climber with rambling and dextrorse stems up to 35 feet high and 6 inches diameter. Bark pale brown, slightly rough and corky except on very old stems. Blaze .25—.7 inch, not fibrous, white or pale yellow closely mottled with orange or orange-brown sclerotic tissue and tinged with chlorophyl, no milky juice. Twigs with conspicuous circular lenticels. Leaves 3—7 by 2.5—5 inches, broadly ovate, abruptly short-acuminate, base cuneate rounded or cordate, pubescent on both surfaces when young, puberulous beneath and glabrescent above when mature, dull green above, somewhat glaucous beneath, lateral nerves 4-5 pairs including the basal prominent beneath, usually glandular at the base of the midrib above. Petiole .75—3 inches long. Flowers .5—.8 inch diameter, unscented, green, in dense drooping umbels, the umbels usually solitary pedunculate and extra-axillary, sometimes 2 or 3 in a cyme. Peduncles 1—3 inches long, puberulous. Pedicels .5—1.5 inches long, slender, puberulous. Corolla at first cup-shaped, ultimately spreading, pubescent outside. Corona green, processes gibbous with a short beak towards the stigma. Follicles solitary or in pairs, pairs

widely divaricate, 3-4 by 1—1·2 inches, slightly tapering to a blunt point, clothed at first with deciduous rusty scurf. Seeds ·4 inch long; coma 1·5—2 inches long.

Occurs in the outer hills and subhimalayan tract up to 3,500 feet. Common in open miscellaneous and *khair* forests of the Bhabar. Flowers: April—July. Fruit: April-May.

12. TYLOPHORA, *R. Br.*

Erect or twining perennial herbs or undershrubs. Leaves opposite. Flowers small or minute in umbelliform or racemose cymes. Calyx 5-partite, glandular within. Corolla rotate; lobes broad, slightly overlapping to the right. Corona staminal, processes fleshy, depressed or swollen, produced down to the corolla base, often free above. Column very short. Anther-tips inflexed, membranous. Stigma disciform, 5-angled. Fruit of 1-2 smooth, usually slender and acuminate follicles. Seeds winged, comose.

Tylophora exilis, *Colebr.*—A slender evergreen climber with dextrorse stems up to 15 feet high and ·15 inch diameter. Leaves 3—5 by 1·25—2·5 inches, ovate or ovate-oblong, gradually acuminate, base rounded or cuneate, margin undulate, membranous, dull green above, somewhat glossy beneath, glabrous or with minute adpressed hairs along the nerves above. Petiole ·5—1·5 inches long. Flowers small in few-flowered umbels, the umbels solitary or several on the branches of extra-axillary cymes. Peduncle 1-2 inches long, very slender. Pedicels not exceeding ·25 inch long. Sepals ovate, hispid. Coronal processes gibbous. Follicles 2·5—4 by ·2·3 inch, tapering at both ends, glabrous, finely striated. Seeds ·3 inch long; coma ·5—1 inch long.

This plant has been collected near Garjia in the Ramnagar Division in *sal* forest at 1,500 feet elevation, and again near Syuni in the Ranikhet Division in *banj* forest at 6,000 feet elevation. I have been doubtful whether to include this species as the stems are scarcely if at all woody, but on the other hand they are perennial whereas the stems of other *Tylophoras* found within our area are, I believe, only annual. Flowers: June. Fruit: April-May.

13. GONGRONEMA, *Dcne.*

Twining shrubs. Leaves opposite. Flowers small, in axillary, umbelliform or racemose cymes. Calyx 5-partite. Corolla urceolate, subrotate or broadly campanulate; lobes slightly overlapping to the right. Corona of 5 short scales adnate to the bases of the anthers, or none. Column short; anther-tips inflexed, membranous, concealing the stigma. Stigma convex clavate or conical. Fruit of 1-2 acuminate follicles. Seeds comose.

Gongronema nepalense, *Dcne.*—A dextrorse climber. Young shoots minutely puberulous. Leaves 3·5—7 by 1·5—3·5 inches, oblong

elliptic or ovate, abruptly short-acuminate, base cordate or sometimes rounded, margin sinuate, puberulous on both surfaces when quite young, glabrous when mature, lateral nerves 7—8 pairs, with several conical glands at the base of the midrib above. Petiole .6—1.5 inches long. Flowers .25 inch diameter, yellow, arranged in subumbellate heads at the ends of the branches of extra-axillary trichotomous pedunculate cymes. Peduncles 1.5—4.5 (rarely 6) inches long. Pedicels .05—.2 inch long, puberulous. Corolla campanulate, glabrous outside, ciliate on the margins of the triangular-oblong petals. Coronal processes obsolete. Follicles often single, widely divaricate when two, 2.5—3 by .2-.3 inch, gradually tapering to an acuminate point, puberulous when young. Seeds .25 inch long; coma 1-2 inches long.

Occurs throughout the subhimalayan tract and central and outer hills between 1,500 and 4,000 feet, but does not appear to be common. Flowers: July-August.

14. GYMNEMA, *R. Br.*

Twining shrubs or undershrubs. Leaves opposite. Flowers small in umbellate cymes. Calyx 5-partite. Corolla sub-rotate, campanulate or urceolate; lobes subvalvate or narrowly overlapping to the right. Corona 0 or corolline of fleshy processes on the throat produced downwards on the tube as double villous ridges. Column short; anther-tips membranous. Stigma large, conical or domed, projecting beyond the anther-tips. Fruit of 1-2 smooth slender acuminate follicles. Seeds margined, comose.

Gymnema tingens, *W. and A.*—An evergreen climber with dextorse stems up to 2 inches diameter and 40 feet high. Bark pale brown, very rough and corky in close ridges with deep furrows between. Blaze .25—.4 inch, cheesy, not fibrous, white, exuding a milky juice which separates on exposure into watery and creamy components. Twigs green, terete, sometimes hollow. Young shoots with a band of hairs running down the internodes. Leaves 4—9 by 2.5—7.5 inches, elliptic-oblong or ovate, abruptly short-acuminate, membranous, base obtuse rounded or subcordate, puberulous on both surfaces when young especially on the nerves beneath, glabrous or glabrescent when mature, dull dark green above, paler beneath; lateral nerves 5—8 pairs. Petiole .75—3 inches long. Flowers .3-.4 inch diameter, pale buff, in pedunculate, umbelliform, pubescent, extra-axillary cymes 1—1.5 inches long. Peduncles .25—.75 inch long. Pedicels slender, .3—.6 inch long. Corolla puberulous outside; tube campanulate. Follicles usually single 4—4.5 by 1 inch, smooth, glabrous.

Occurs throughout the area up to 4,000 feet. Fairly common in *sal* forests of the Bhabar, scarce in the hills. Flowers: June—August. Fruit: November—March.

15. MARSDENIA, *R. Br.*

Twining, rarely erect shrubs. Leaves opposite. Flowers in umbellate or corymbose cymes or panicles. Calyx 5-partite, usually glandular within. Corolla campanulate urceolate or rotate, lobes overlapping to the right. Corona single or double; corolline thickened or fleshy and a villous ring in the throat or none; staminal of 5 appendages, fleshy flattened and membranous above with erect tips incumbent on the anther, or exceeding it and meeting over the top of the stigma, rarely obsolete. Column short; anther-tips membranous. Stigma convex or elongated. Fruit of 1-2 lanceolate or poniard-shaped follicles. Seeds margined, comose.

- I.—Mature leaves dark glossy green and glabrescent above. Flowers dark purple in single umbels ... 1. *lucida*.
 II.—Mature leaves dull green and pubescent above.
 1. Flowers orange-red in cymes 1-2 inches across... 2. *Roylei*.
 2. Flowers greenish-yellow in cymes 2-5 inches across ... 3. *tenacissima*.

1. **Marsdenia lucida**, *Edgew.*—An evergreen climber with dextrorse stems up to 40 feet high and 1 inch diameter. Bark pale brown, smooth, with conspicuous raised circular lenticels. Blaze 1-2 inch, white or pale yellow, with long silky fibre, exuding milky juice. Young shoots and leaves clothed all over with pale brown pubescence. Leaves 3-5-7-5 by 2-4 inches, elliptic or ovate-oblong, rather abruptly acute or acuminate, base rounded or cordate, rather thick, glabrescent when mature, dark glossy green above, pale dull yellowish-green beneath. Petiole 6-1-6 inches long, stout, channelled above. Flowers 6-8 inch diameter, fragrant, dark purple or purplish-red in many-flowered dense pedunculate extra-axillary umbels 1-2-5 inches across. Peduncles 5-2-5 inches long, stout, clothed with pale brown pubescence. Pedicels 4-6 inch long, stout, pubescent. Corolla sub-campanulate, clothed on the inside with short white hairs. Coronal scales subulate, as long as the anthers. Follicles solitary, 3-5-5 by 75-1 inch, straight, beaked, glabrous, pericarp finely striate. Seeds 5-6 inch long; coma 1-5 inches long.

Occurs throughout the central and outer hill ranges between 5,000 and 8,500 feet. Generally scarce but may be locally common as for instance at Naini Tal. Usually in dense oak forest. Flowers: July-October. Fruit: March-April.

2. **Marsdenia Roylei**, *Wight*. Vern. *Murkhila*, A.—A climber with dextrorse stems up to 25 feet high and 1-5 inches diameter. Bark pale brown, rough, corky and deeply fissured on old stems. Blaze 15-3 inch, rather fibrous, white streaked with pale orange, exuding milky juice. Twigs pale, with conspicuous lenticels, pubescent or tomentose. Leaves 4-7 by 2-5-5 inches, ovate, acuminate, base

cordate, pubescent on both surfaces, dull green above; basal nerves 3—5, lateral nerves 3—5 pairs above the basal, prominent beneath. Petiole 1·5—3·5 inches long, terete, tomentose. Flowers 3 inch diameter, orange-red, in compact, many-flowered, erect, pedunculate, extra-axillary cymes 1-2 inches across. Peduncles 5—1·5 inches long, stout, tomentose. Pedicels 1-2 inch long, tomentose. Corolla campanulate, pubescent without, villous within. Corona of 5 slender subulate processes with free, erect, converging tips much exceeding the anthers. Follicles solitary, 3 by 1 inch, straight, beaked, hairy with thick deeply-wrinkled pericarp.

Occurs throughout the hills between 4,000 and 7,000 feet. Fairly common both in scrub and in oak forests, often on rocky ground. Flowers: May—July.

3. *Marsdenia tenacissima*, W. and A.—A deciduous dextrorse climber with stems up to 12 feet high and 5 inch diameter. Bark pale brown, fairly smooth becoming deeply furrowed and corky when old. Blaze with milky juice. Young shoots and leaves softly pubescent or tomentose. Leaves 4—7 by 3—5 inches (rarely up to 9 by 8 inches), broadly ovate, apex abruptly short-acuminate or with a short cusp, base deeply cordate with rounded lobes, basal nerves 5—7 with 2 or 3 lateral pairs above the basal, pale dull green on both surfaces, more or less pubescent even when mature. Petiole 1·5—2·5 inches or rarely up to 4·5 inches long, terete, tomentose. Flowers 4-5 inch diameter, rather waxy, greenish-yellow with a somewhat offensive odour, more or less fascicled on the tomentose branches of extra-axillary branched cymes 2—5 inches across. Pedicels 15—45 inch long, tomentose. Calyx densely pubescent. Corolla subcampanulate, densely pubescent outside. Corona with erect linear-oblong appendages which curve over the top of the stigma, their bases dividing into two fleshy ridges. Follicles usually solitary, 4·5—5 by 1·2—1·4 inches, gradually tapering to a short blunt point, with longitudinal wrinkles, densely hairy. Seeds 4 inch long; coma 2 inches long.

Occurs probably throughout the central and outer hill ranges as well as the subhimalayan tract, but it appears to be scarce. Flowers: April—June. Fruit: January—March.

16. *LEPTADENIA*, R. Br. c

Shrubs, climbing or erect and then with stiff almost leafless stems. Leaves opposite. Flowers small in axillary umbelliform cymes. Calyx 5-lobed, eglandular. Corolla sub-rotate; lobes spreading pubescent or bearded, valvate in bud. Corona double; corolline of small processes in the throat between the lobes; staminal of an annular thickening or undulate wing. Column short; anther-tips inflexed, with or without appendages. Stigma 5-angled. Fruit of 1-2 thick smooth follicles. Seeds winged, comose.

Leptadenia reticulata, *W. and A.*—A deciduous climber with dextrorse stems up to 15 feet high and 3 inches diameter. Bark pale yellowish-brown, very rough and somewhat corky with rather deep furrows. Blaze .25 inch, not fibrous, very hard, pale orange, without milky juice. Twigs smooth, not lenticellate, with silky fibrous bark. Young parts hoary-tomentose. Leaves 1.5—3 by .5—2 inches, ovate or ovate-lanceolate, base usually truncate or rounded sometimes cuneate or subcordate, apex acute or short-acuminate, coriaceous glabrous or puberulous above, shortly hairy or pubescent beneath when mature, lateral nerves 5—7 pairs. Petiole .5—1 inch long. Flowers .2—3 inch diameter, greenish-white or yellow, in many-flowered umbellate cymes. Peduncle .25—.5 inch long, puberulous. Pedicels .15—.25 inch long, puberulous. Corolla funnel-shaped; lobes villous on both surfaces. Corona of 5 broad, low, fleshy, rather inconspicuous processes. Follicles solitary, 2.5—3.5 by .8—1 inch, widest about one-third from the base, glabrous, with a raised ridge running down one side. Seeds .2—.25 inch long; coma 1.2—1.5 inches long.

Only recorded from the Ramnagar Division where it was found growing on the banks of the Kosi river opposite Garjia at 1,400 feet elevation. Flowers: June—August.



LX.—LOGANIACEÆ.

Trees, erect or climbing shrubs or herbs. Leaves opposite, simple; stipules present or reduced to a transverse line. Flowers usually regular, hermaphrodite, in simple or compound cymes, sometimes solitary, cymes rarely capitate. Calyx small, inferior, lobes 4-5. Corolla gamopetalous, 4-5-lobed, the lobes imbricate or valvate. Stamens 4-5, inserted on the corolla-tube, alternate with the lobes. Ovary free, usually 2-celled; ovules 1-many in each cell; style simple; stigma capitate or bifid. Fruit a septicidal capsule or indehiscent berry.

Erect shrubs. Fruit a capsule	...	...	...	1. <i>Buddleia</i> .
A climber. Fruit a berry	...	...	...	2. <i>Gardneria</i> .

1. BUDDLEIA, *Linn.*

Trees or shrubs. Leaves entire or toothed, united by a stipular line. Flowers 4-merous, in axillary or terminal and paniced sometimes very dense or globose cymes. Calyx campanulate. Corolla campanulate, tubular or sub-rotate; lobes imbricate. Anthers subsessile. Ovary 2-celled; ovules many in each cell; stigma clavate or capitate. Fruit a septicidally 2-valved capsule. Seeds many.

Leaf-base cordate or hastate. Flowers lilac	...	1. <i>paniculata</i> .
Leaf-base narrowed into the petiole. Flowers white	...	2. <i>asiatica</i> .

1. *Buddleia paniculata*, *Wall.* Vern. *Phurpattia* or *Daia*, NG.—

An erect deciduous or subdeciduous shrub 4—8 feet high with stems up to 4 inches diameter. Bark pale brown exfoliating in thin fibrous strips. Twigs, leaves beneath and inflorescence clothed with soft white tomentum. Leaves variable in size, usually 3—6 by 1½—2 inches, ovate or oblong, base cordate or hastate, margins coarsely sinuate-dentate; those on flowering shoots often smaller, entire with cuneate or rounded base; all thick, nerves depressed above, clothed above with deciduous white or tawny tomentum, densely white-tomentose beneath. Petioles up to 1 inch long, tomentose, usually not winged but sometimes broadly winged, the wings amplexicaul or not. Stipules represented by merely a raised line uniting the petioles, or rarely forming a broad band up to 1 inch wide. Flowers 3-4 inch diameter, mauve or pale lilac, fragrant, in short dense spikes arranged in a leafy interrupted terminal panicle. Corolla-tube 2½—3 inch long, cylindric, deep orange inside. Capsule 2—2½ inch long ellipsoid, tomentose.

Occurs throughout the hills between 3,500 and 8,500 feet. Fairly common on bare southern and rocky slopes. Flowers: March—May.

2. *Buddleia asiatica*, *Lour.* Vern. *Sinwāli*, *H.* and *R.*—An evergreen shrub up to 10 feet high and stems up to 1 inch diameter. Twigs, leaves beneath and inflorescence clothed with a thin, nearly white, felted, stellate tomentum. Leaves 3—6 by .75—1.5 inches, lanceolate, acuminate, entire or serrulate, upper surface with scattered stellate white hairs when young becoming glabrous when mature, base narrowed, lateral nerves 11—13 pairs, depressed above and prominent beneath. Petiole 0—4 inch long. Flowers .2 inch diameter, white, faintly scented or not, solitary or fascicled, in dense terminal and axillary solitary or paniced usually continuous spikes 2—8 inches long. Corolla .15—.25 inch long, tomentose without and in the throat. Capsules .2 inch long, ellipsoid, glabrous, on short deflexed pedicels. Seeds minute.

Occurs throughout the area up to 4,500 feet. Fairly common in exposed places, often in dry stream-beds or on landslips or eroded slopes. Frequently cultivated in gardens. Flowers: January—April Fruit: December-January.

2. GARDNERIA, *Wall.*

Climbing glabrous shrubs. Leaves entire, the petioles connected by a stipular line. Flowers in axillary pedunculate cymes. Calyx small, deeply 4-5-lobed. Corolla rotate; lobes 4-5, thick, valvate in bud. Stamens 4-5; filaments very short; anthers subconnate. Ovary 2-celled; ovules 1 in each cell; stigma shortly 2-lobed. Fruit a globose 2-seeded berry, the pericarp fleshy.

Gardneria angustifolia, *Wall.*—An evergreen climber with dextrorse stems up to 6 feet high and .5 inch diameter, glabrous except the flowers. Bark pale, slightly rough owing to numerous small raised circular lenticels. Twigs smooth, green, terete. Leaves 2.5—4.5 by .7—1.4 inches, lanceolate, acute or acuminate, base rounded or obtuse, margin undulate, coriaceous, somewhat glossy on both surfaces; lateral nerves rather indistinct about 7—10 pairs. Petiole .1—.5 inch long, rather deeply grooved above. Flowers .5—.6 inch diameter, white, waxy, scented, usually solitary and axillary rarely in 2-3-flowered cymes. Peduncles .4—.9 inch long, curved downwards in flower, rarely two in a leaf-axil. Calyx less than .05 inch long, obscurely lobed. Corolla cup-shaped, glabrous without, villous within. Berry .25—.4 inch diameter, globose, shining, scarlet, crowned with the persistent style. Seeds black, embedded in orange-coloured pulp.

Occurs probably throughout the central and outer hill ranges between 6,000 and 8,000 feet. Fairly common in shady oak forest, especially of *Quercus dilatata*, but it seems to be local and has not yet been collected in Garhwal. Flowers: May-June. Fruit: April-May.

LXI.—BORAGINACEÆ.

Herbs shrubs or trees, rarely climbers, often hispid or scabrous. Leaves alternate, rarely opposite, exstipulate. Flowers usually regular and 5-merous, exceptionally 4- or 6—8-merous, hermaphrodite or rarely polygamous, usually in dichotomous scorpioid cymes, rarely solitary or sub-racemose. Calyx inferior. Corolla gamopetalous, often with scales in the throat; lobes imbricate in bud, rarely twisted. Stamens on the corolla-tube. Ovary 2-celled with 2 ovules in each cell or 4-celled with 1 ovule; style simple or forked, stigmas capitate or 2-lobed. Fruit a drupe or dividing into 2—4 nutlets.

I.—Trees.

- | | | |
|--|-----|---------------------|
| 1. Style twice forked. Calyx shortly lobed. | ... | 1. <i>Cordia</i> . |
| Drupe more than .3 inch diameter | ... | |
| 2. Style bifid. Calyx deeply lobed. Drupe less | ... | 2. <i>Ehretia</i> . |
| than .3 inch diameter | ... | |
| II.—A small shrub | ... | 3. <i>Rhabdia</i> . |

1. *CORDIA*, Linn.

Trees or shrubs, sometimes scandent. Leaves alternate or sub-opposite, entire or toothed. Flowers polygamous, in dichotomous corymbose cymes or clusters. Calyx tubular or campanulate, accrescent in fruit, teeth usually short, often irregular. Corolla tubular or funnel-shaped or campanulate; lobes 4—8, reflexed. Stamens 4—8, usually hairy at the base; anthers exserted. Ovary 4-celled. Style twice forked. Fruit a drupe; stone hard 1—4-celled.

- | | | |
|---|-----|---------------------|
| Bark with close longitudinal cracks. Leaves not or | ... | 1. <i>obliqua</i> . |
| scarcely scabrous above. Calyx not ribbed, glabrous | ... | |
| without | ... | |
| Bark quite smooth. Leaves scabrous above. Calyx | ... | 2. <i>vestita</i> . |
| ribbed, pubescent outside | ... | |

1. *Cordia obliqua*, Willd. Syn. *C. Myxa*, Linn. of many authors. Vern. *Lisōra* or *Lisāra*, Gen. *Bhērao*, R.—A medium-sized deciduous tree up to 7 feet girth and 75 feet high. Bark pale brown, fairly smooth or roughish, with close longitudinal shallow cracks and often with a few distant deep fissures on old stems. Blaze .6—1 inch, coarsely fibrous, soft, pale yellow or whitish rapidly turning dirty green on exposure. Young shoots more or less tomentose. Leaves alternate, 3—5 by 2.5—4.5 inches, variable, orbicular broadly ovate ovate-elliptic or obovate, obtuse or more or less abruptly acuminate, base rounded or cuneate, margin entire or more or less sinuate-dentate,

glabrous or nearly so above, more or less pubescent especially in the axils of the nerves beneath, lateral nerves 4—7 pairs of which 1-2 pairs are basal. Petiole .7—1.5 inches long. Flowers .2—.4 inch diameter, white, fragrant, in terminal and axillary, lax, pedunculate cymes 2—4 inches across. Peduncles 1-2 inches long, usually terminating short lateral branches. Pedicels short. Calyx .2 inch long, glabrous, not ribbed, persistent and much enlarged in fruit. Corolla-tube as long as the calyx. Drupe .4—.75 inch diameter, globose or ovoid, yellowish or pinkish containing a single large stone surrounded by milky-white sticky mucilage.

Occurs throughout the area up to 5,000 feet. Very common and found in most types of moist forest. Flowers: March-April. Fruit: June-July.

2. *Cordia vestita*, Hook. f. and T. Vern. *Batrula*, G. Bariul, R.—A small deciduous tree with crooked stem up to 4 feet girth and 35 feet high. Bark greenish-grey, quite smooth, exfoliating in long thin reddish-brown strips which disclose the new greenish-yellow bark beneath. Blaze .35—.75 inch, soft, cheesy, pale yellow rapidly turning orange-brown on exposure. Young shoots clothed with rusty-brown tomentum. Leaves alternate, 4—8 by 3—6 inches, orbicular broadly ovate or obovate, apex usually rounded, base rounded or cuneate; margins undulate, scabrous above, tomentose but ultimately glabrous beneath, lateral nerves 4—7 pairs of which 1-2 pairs are basal or subbasal. Petiole 1—1.5 inches long. Flowers .5 inch diameter, yellowish-white, in dense compound cymes; males in unilateral racemes. Peduncles and pedicels tomentose. Calyx .4 inch long, pubescent and more or less ribbed without, persistent and somewhat enlarged in fruit. Corolla-tube as long as the calyx. Drupe .6—.8 inch diameter, depressed-globose, yellow, about one-third embedded in the accrescent calyx, containing a single stone surrounded by a viscous translucent jelly.

Occurs throughout the area between 1,000 and 4,000 feet. Fairly common in miscellaneous forests along the outer hill ranges. Flowers: March-April. Fruit: June-July.

2. EHRETIA, Linn.

Trees or shrubs. Leaves alternate. Flowers small, white, in corymbose or paniced cymes, rarely solitary. Calyx small, 5-partite. Corolla with a short cylindric tube; lobes 5. Stamens 5, usually exserted. Ovary 2-celled; style 2-fid or 2-partite; stigma capitate. Fruit a drupe with one 4-celled, two 2-celled or four 1-celled pyrenes, one or more of the pyrenes or seeds frequently suppressed.

Leaves serrate. Flowers .15—.2 inch diameter

... 1. *acuminata*.

Leaves entire. Flowers .3—.5 inch diameter

... 2. *lavis*.

1. *Ehretia acuminata*, R. Br. Vern. *Punēra*, NG. *Pudila*, H.—A medium-sized or fairly large deciduous tree up to 6 feet girth and 60 feet high. Bark pale bluish-grey often silvery-white in parts, fairly smooth with rather distant shallow or deep vertical fissures. Blaze .5—1 inch, soft, fibrous, the fibres interlacing and giving a cellular appearance, pale yellow rapidly turning orange-brown on exposure. Young shoots pubescent. Leaves 3—7 by 1.2—2.5 inches, usually elliptic-oblong, acute or acuminate, sharply serrate, teeth with incurved points when young, base narrowed rarely rounded, midrib sparsely adpressed-hairy above and nerves slightly hairy in the axils beneath, usually with a few scattered hairs on the upper surface otherwise glabrous, lateral nerves 6—9 pairs. Petiole .5—1.2 inches long. Flowers .15—.2 inch diameter, white, scented, sessile, clustered on the branches of dense, pyramidal, terminal, pubescent panicles 3—6 inches long, the lower branches often axillary. Corolla twice as long as the calyx. Drupe .15 inch diameter, globose or ellipsoid, nearly black when ripe, with 2 pyrenes and 4 seeds.

Occurs throughout the area up to 6,000 feet. Never very common but generally distributed. Usually found bordering streams in open situations. I have measured a tree in North Garhwal 10.5 feet girth and 80 feet high. Flowers: March—June. Fruit: June-July.

2. *Ehretia laevis*, Roxb. Vern. *Khōda*, Gen. *Chamrōr*, Gen. *Mēndu*, G.—A small deciduous tree up to 4 feet girth and 35 feet high. Bark pale yellowish-brown or ashy white, smooth, often thinly mealy on the surface, with small raised lenticels and sometimes with horizontal cracks or wrinkles. Blaze .35—.6 inch, soft, not fibrous, white or pale yellow lightly freckled with orange or reddish-brown, the whole rapidly turning orange-brown on exposure. Young shoots glabrous or with a scurfy pubescence. Leaves 3—7 by 2—4 inches, very variable, usually broadly elliptic or elliptic-obovate, apex rounded or acuminate, base usually cuneate, usually glabrous or nearly so when mature but sometimes pubescent, dark glossy green on both surfaces; lateral nerves 5—8 pairs, prominent beneath. Petiole .5—1 inch long. Flowers .3—.5 inch diameter, white, faintly scented, sessile or shortly pedicelled, in axillary and terminal dichotomous scorpioid cymes 2—4 inches across, appearing before or with the young leaves. Corolla-tube exceeding the calyx. Drupe .15—.35 inch diameter, depressed-globose, somewhat 2—4-lobed, of a deep orange colour, mostly 4-seeded, the seeds surrounded by juicy pulp.

Occurs throughout the area up to 3,500 feet. Common both in dry miscellaneous and *sal* forests. The leaves have a slightly foetid smell when crushed. Flowers: February—April. Fruit: April-May.

3. RHABDIA, *Mart.*

A shrub. Leaves small, alternate or clustered. Flowers small, 5-merous, terminal or in few-flowered terminal racemes on short lateral branches. Calyx 5-partite; lobes imbricate. Corolla deeply 5-cleft; tube short; lobes imbricate. Stamens 5. Ovary 2-celled with 2 ovules in each cell, or imperfectly 4-celled with 1 ovule in each cell; stigma capitate or minutely 2-lobed. Fruit a drupe with 4 crustaceous 1-seeded pyrenes.

Rhabdia lycioides, Mart.—A small shrub 2—4 feet high with erect or prostrate straggling branches. Young shoots glabrous or pubescent. Leaves alternate, .5—1.2 by .2—.35 inch, linear or spathulate, entire, apex rounded and sometimes apiculate, base narrowed, glabrous or more or less densely adpressed-hairy. Petiole .05 inch long. Flowers .25—.4 inch diameter, pink or reddish-lilac, on short pedicels, usually 2-3 at the ends of short lateral branches. Calyx .2 inch long, persistent, fleshy, sparsely hairy; lobes lanceolate, acuminate. Corolla subcampanulate; lobes spreading, twice as long as the tube. Drupe .15 inch diameter, subglobose, orange-red.

Occurs along the bed of the Kali river in East Almora between Sheem and Bhergaon according to Mr. W. J. Lambert. Duthie also recorded it from this part though there are no specimens from our area at Dehra Dun. This shrub is found in rocky river beds, frequently in such a position that it is completely submerged during the rains. According to Mr. J. F. Duthie the plant found in Kumaon is Edgeworth's *R. sericea* which is distinguished by its very silky pubescence. Flowers: October-November.

LXII.—CONVOLVULACEÆ.

Herbs or shrubs, usually twining, rarely trees. Leaves alternate or in parasitic species absent, exstipulate. Flowers regular, hermaphrodite, in axillary bracteate cymes, rarely solitary. Calyx of 5 sepals, free or connate at the base, persistent and sometimes accrescent or winged in fruit. Corolla campanulate, funnel-shaped or subrotate; limb subentire to deeply 5-lobed, usually plaited in bud. Stamens 5, rarely 4, on the corolla-tube. Disk usually annular. Ovary superior of 2 (rarely 3—5) carpels, 1—4-celled; ovules 2 in each carpel; styles 1-2 or almost nil; stigmas various. Fruit a berry or capsule dehiscent by 2 valves or circumsciss or irregularly. Seeds 4—2, rarely 1.

I.—Flowers small, very numerous in panicles ... 1. *Porana*.

II.—Flowers large, solitary or few together.

1. Leaves glabrous above, silky beneath.

Flowers white ... 2. *Rivea*.

2. Leaves roughly hairy on both surfaces.

Flowers purple ... 3. *Lettsomia*.

1. PORANA, *Burm.*

Scrambling or twining shrubs. Leaves entire, usually cordate. Flowers in copious panicles. Calyx of 5 small sepals when in flower, very accrescent in fruit, developing into large veined wings. Corolla campanulate or funnel-shaped; limb subentire or lobed. Filaments slender. Disk annular or nil. Ovary 2-celled; ovules 2—4. Fruit a membranous capsule, indehiscent or 2-valved. Seed 1.

Porana paniculata, *Roxb.* Vern. *Bārūnī*, K and R. Eng. Bridal Wreath.—An evergreen climber with dextrorse stems up to 40 feet high and 2·5 inches diameter. Bark pale yellowish-brown, rough and rather corky. Blaze .05—·2 inch, whitish turning brown on exposure. Twigs clothed with dense short grey tomentum. Leaves variable in size, usually 3—7 by 2—6 inches, often much smaller in the region of the inflorescence, ovate, acuminate, base cordate, membranous, softly grey-pubescent on both sides but chiefly beneath, ultimately glabrescent except the nerves, basal nerves 5—7. Petiole usually 1—4·5 inches long, tomentose. Flowers .15—·2 inch diameter, white, faintly scented, very numerous, in large axillary and terminal leafy drooping panicles. Bracts leaf-like, persistent. Corolla .2—·25 inch long, campanulate, shortly lobed. Capsule .3 inch long, ovoid, pubescent or tomentose, supported by the persistent calyx of which 3 or all the sepals are enlarged.

Occurs throughout the area up to 4,500 feet. Common in open scrub and miscellaneous forests. Flowers: October-November. Fruit: January.

2. RIVEA, *Choisy*.

Erect or twining shrubs. Leaves cordate. Flowers in few-flowered cymes, often supported by large bracts at their base. Calyx of 5 sepals. Corolla large, salver-shaped, scarcely lobed. Disk annular. Stamens included; filaments sometimes bearded at the base. Ovary 4-celled with 4 ovules; style slender; stigmas 2, linear-oblong. Fruit baccate or indehiscent and nearly dry, pericarp ultimately breaking up irregularly.

Rivea ornata, Choisy.—A shrub with weak suberect and spreading or dextrorse stems 2—6 feet high and up to .35 inch diameter. Twigs with a large pith and more or less densely covered with whitish hairs. Leaves orbicular-cordate or reniform, broader than long, 2—5 by 3—7 inches, apex rounded or retuse often apiculate, entire, glabrous above, more or less densely clothed with whitish adpressed silky pubescence beneath, basal nerves 7—9. Petiole 1.5—5 inches long, silky pubescent, with a large greenish gland on either side of the apex beneath. Flowers 2.5—3.5 inches diameter, white, fragrant, in axillary peduncled 2—7 flowered heads. Peduncles 1—5 inches long, stout, densely hairy. Pedicels very short. Bracts linear .5—7.5 inch long. Sepals .5—7.5 inch long, broadly oblong, acute, thickly hairy without. Corolla-tube 2-3 inches long; limb twisted to the left and sparsely hairy without in bud, glabrous after expanding. Capsule .4-.5 inch diameter, globose, smooth, glossy, chocolate-brown; the thin outer envelope loosely enclosing 1—4, usually 4 seeds surrounded by thin white mealy tissue.

Occurs throughout the area up to 3,500 feet. Rather scarce. Usually in dry places. The species described above is probably var. *Griffithii*, F. B. I. though the corolla is there described as glabrous even in bud. The corolla is probably glabrous or slightly hairy in bud. Flowers: July—September. Fruit: October—December.

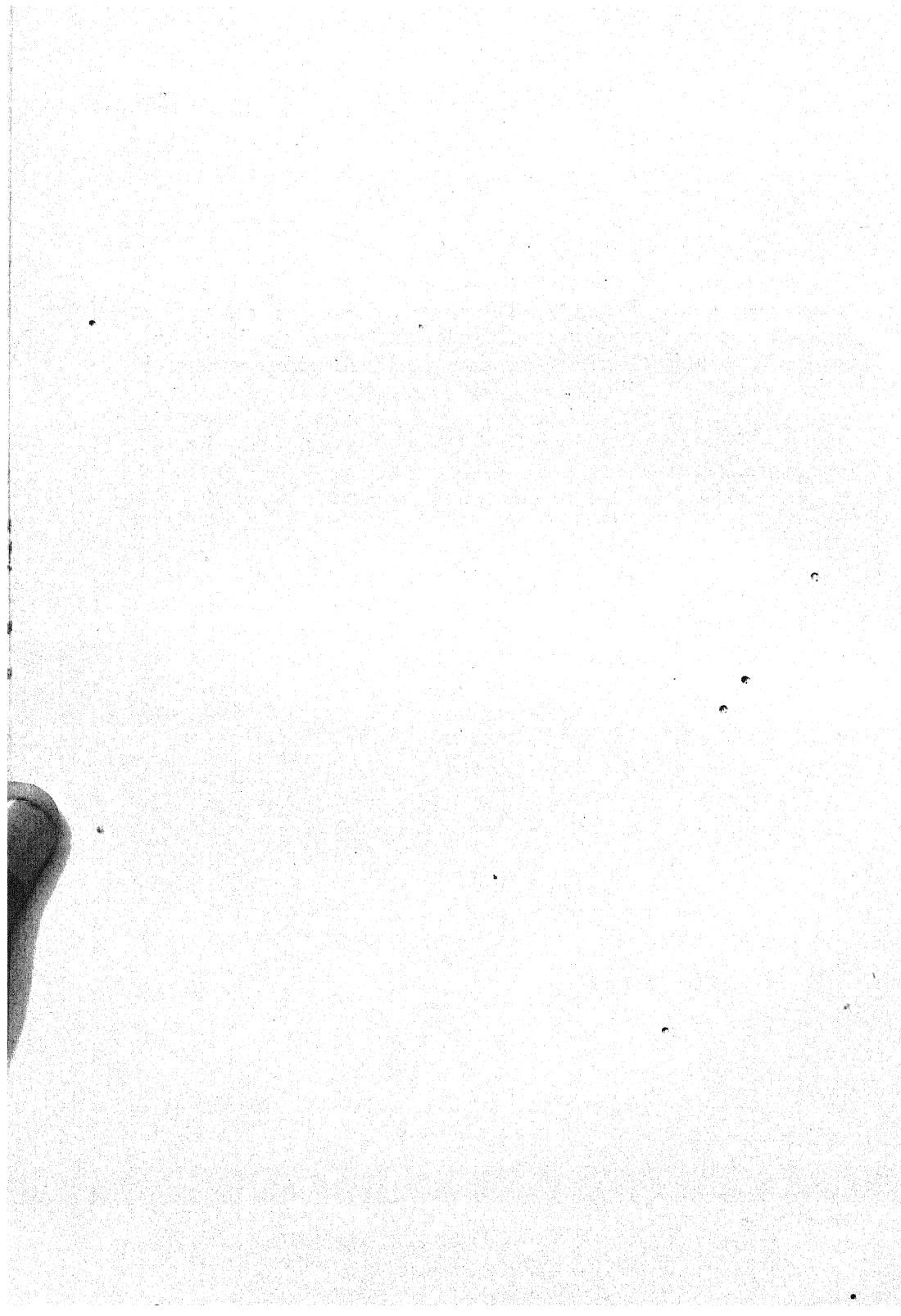
3. LETTSOMIA, *Roxb.*

Climbing shrubs. Flowers in peduncled corymbose or capitate cymes; bracts conspicuous. Calyx of 5 sepals, more or less accrescent and often thickened and enlarged in fruit. Corolla tubular, funnel-shaped, lobes small. Stamens 5, usually included; filaments usually enlarged and villous at base. Disk annular. Ovary 2-celled, 4-ovuled; style filiform; stigma of 2 rounded lobes. Fruit baccate, indehiscent, sometimes dry, 4—1-seeded.

Lettsomia Thomsoni, Clarke.—A dextrorse climber, the shoots dying back annually to a persistent basal portion which attains 10 feet long and 1 inch diameter. Bark pale brown, slightly rough. Blaze .1 inch, fibrous, exuding a milky juice. Twigs rough, clothed with long spreading bristly pale hairs. Leaves variable in size, usually 3—6 by 2—4 inches, ovate, gradually acuminate, base more or less deeply

cordate, entire, clothed on both surfaces with long bristly spreading hairs, dull green above; lateral nerves 10—13 pairs, prominent, nearly parallel, abruptly curved upwards near the leaf-margin, the bases of the lowest 2—4 pairs approximate. Petiole .5—3 inches long, hairy. Flowers 1—1.5 inches diameter, purple, in axillary peduncled usually 1—3-flowered heads. Peduncles .5—4 inches long, pubescent. Pedicels usually very short. Bracts .3—5 inch long, oblong or oblanceolate, deciduous, much less hairy than the sepals. Sepals .5 inch long, densely fulvous-hirsute without, coriaceous and somewhat enlarged in fruit. Corolla 1.5—2 inches long, with fulvous hairs on the lanceolate bands outside. Fruit .4—5 inch diameter, ovoid, rather fleshy, smooth, shining, bright orange or orange-red. Seeds 2—4, .2 inch diameter, pale brown.

Occurs probably throughout the area up to 4,500 feet, but is scarce. Sometimes found on dry, hot, southern slopes. Flowers: September-October. Fruit: November-December.



LXIII.—SOLANACEÆ.

Herbs or shrubs erect or climbing or rarely small trees. Leaves alternate, often in unequal pairs, rarely clustered, never truly opposite, usually simple, exstipulate. Flowers regular and 5-merous (except in the gynoecium), more rarely zygomorphic, or 6-7-merous in cymes or on solitary or clustered pedicels. Calyx inferior, usually persistent. Corolla funnel-shaped campanulate or rotate, often plicate. Stamens on the corolla-tube. Ovary 2-celled or imperfectly 1- or 4-celled, rarely 3—5-celled; ovules many, on prominent peltate placentae; style simple; stigma 2-lobed or-partite. Fruit baccate or capsular, usually 2-celled, many-seeded.

- | | | |
|--|-------------------|----------------------|
| Calyx in fruit not overtopping the berry. | Stamens dehisc. | |
| • ing apically | | 1. <i>Solanum</i> . |
| Calyx in fruit enclosing the berry. | Stamens dehiscing | |
| longitudinally | | 2. <i>Withania</i> . |

1. SOLANUM, Linn.

Herbs or shrubs, sometimes climbing, rarely small trees, sometimes spinous. Leaves alternate or subopposite, entire lobed or pinnatifid. Flowers cymose, rarely solitary. Calyx 5—10-toothed, not or somewhat enlarged in fruit. Corolla rotate, rarely campanulate; limb plicate, usually 5-lobed. Filaments short; anthers usually connivent in a cone. Ovary usually 2-celled. Fruit a berry.

- | | |
|---|----------------------------|
| I.—Unarmed. Flowers white | 1. <i>verbascifolium</i> . |
| II.—Armed. Flowers mauve or violet. | |
| 1. Flowers in racemose cymes only. Berry 4-5
inch diameter | 2. <i>indicum</i> . |
| 2. Flowers in cymes or solitary. Berry 8-13
inch diameter | 3. <i>incanum</i> . |

1. *Solanum verbascifolium*, Linn. Vern. *Asēdu* or *Ashētu*, Gen. *Ban-tamākhū*; Gen.—An evergreen shrub or small tree up to 20 feet high and 6 inches diameter. Bark pale brown, fairly smooth, with conspicuous circular raised lenticels. Blaze 15—3 inch, somewhat fibrous inside, pale yellow or whitish tinged with chlorophyl towards the exterior. Twigs leaves and inflorescence clothed with a dense pale tomentum of scurfy stellate hairs. Leaves 6—12 by 3—6 inches, elliptic-lanceolate or elliptic-ovate, acuminate, entire, velvety-pubescent above, densely woolly beneath, base acute or sometimes rounded, lateral nerves 8—12 pairs. Petioles 1-2 inches long. Flowers

·5—·75 inch diameter, white, in woolly dichotomous pedunculate cymes 2—5 inches across. Peduncles 1—4 inches long, stout, terminal in flower becoming lateral in fruit. Pedicels ·1—·2 inch long, stout. Calyx densely stellate-woolly. Corolla ·4—·5 inch long; lobes stellately-pubescent outside. Berry ·3—·5 inch diameter, globose, yellow, stellately pubescent at first, supported by the somewhat enlarged calyx.

Occurs throughout the area up to 4,500 feet. Common, especially on waste ground and in moist localities. Flowers and fruit throughout the year, but chiefly May—October.

2. *Solanum indicum*, Linn. Vern. *Ban-bhatta*, Gen.—An erect shrub 3—8 feet high with stems up to 1·5 inches diameter. Bark pale brown, fairly smooth, thinly corky, lenticellate. Stems and branches armed with yellowish, compressed, often curved, short prickles. Leaves 2—6 by 1—3 inches, ovate, subentire sinuate or lobed, stellately pubescent above, tomentose beneath, base cordate truncate or cuneate, often unequal-sided, lateral nerves about 3-4 pairs. Petiole ·5—1·5 inches long. Petiole and midrib on both sides, and sometimes the lateral nerves also, armed with straight yellowish prickles. Flowers ·9—1·3 inches diameter, mauve or violet, in extra-axillary racemose cymes 1·5—2 inches long. Pedicels ·3—·5 inch long, tomentose, often prickly. Calyx tomentose, often prickly. Corolla ·3—·5 inch long, stellately hairy outside. Stamens bright yellow. Berry ·4—·5 inch diameter, globose, smooth, bright orange-yellow, supported by the persistent calyx which is not enlarged.

Occurs throughout the area up to 5,000 feet. Common on waste ground, frequently on gravelly banks bordering streams. Flowers and fruit throughout the year.

3. *Solanum incanum*, Linn.—An erect shrub 2—5 feet high with stems up to 1·25 inches diameter. Bark pale greenish-grey or ashy white with numerous circular raised lenticels. Stems and branches armed with compressed, straight or slightly curved short prickles. Leaves 3—6 by 1·5—3 inches, elliptic, subentire sinuate or shallowly lobed with rounded lobes, stellately pubescent above, tomentose beneath; base cordate truncate or cuneate, often very unequal-sided. Petiole ·5—1·5 inches long. Petiole, midrib on both sides and sometimes the lateral nerves also, usually armed with straight prickles. Flowers 1 inch diameter, mauve, solitary or several in a racemose cyme. Calyx tomentose, often prickly. Corolla ·5—·75 inch long, stellately hairy outside. Stamens yellow. Berry ·8—1·3 inches diameter, globose, smooth, bright yellow, supported by the persistent enlarged calyx. Seeds numerous embedded in green pulp.

Occurs in the subhimalayan tract and outer hill ranges up to 4,000 feet. Probably scarce. The cultivated form with large oval fruits is distinguished as *S. melongena*, Willd. This is the well known *brinjal* or egg-plant. In flower and fruit most of the year.

2. WITHANIA, Pauq.

Unarmed shrubs, often hoary-tomentose. Leaves entire. Flowers white or yellowish, axillary, sometimes polygamo-dioecious, fascicled or solitary. Calyx campanulate, 5-toothed, enlarged and subglobose in fruit. Corolla tubular-campanulate; lobes 3—6, valvate in bud. Stamens 5, at the base of the tube. Ovary 2-celled; stigma shortly bifid. Fruit a berry, enclosed in the enlarged calyx.

Leaves 2—5 inches long, thin, ovate. Flowers bisexual.

Berry loosely enclosed in the calyx ... 1. *somnifera*.

Leaves 1—3 inches long, thick, oblong-lanceolate.

Flowers unisexual. Berry tightly enclosed in the calyx ... 2. *coagulans*.

1. **Withania somnifera**, Dunal.—An evergreen undershrub 2—4 feet high. Branches clothed with mealy stellate hoary tomentum. Leaves 2—5 by 1—3 inches, ovate, subacute, thin, more or less pubescent especially along the nerves, base narrowed into the petiole. Petiole 3—1 inch long. Flowers 2 inch diameter, greenish or yellowish, fascicled usually about 5 together in the leaf-axils. Pedicels 0—2 inch long. Calyx 2 inch long, mealy-tomentose. Corolla 25—35 inch long, tomentose outside. Berry 25—3 inch diameter, red, globose, smooth, enclosed in the inflated membranous calyx which is 5—8 inch long, globose, slightly angled, with very narrow mouth and unaltered lobes.

Occurs in the subhimalayan tract at elevations probably not exceeding 1,000 feet. On waste ground. Flowers and fruit almost throughout the year.

2. **Withania coagulans**, Dunal.—A small shrub with suberect stems 1-2 feet high and up to 75 inch diameter. Branches densely clothed with grey tomentum. Leaves 1—3 by 4—2 inches, usually lanceolate-oblong, sometimes ovate, obtuse, thick, clothed with a minute persistent not easily detachable greyish tomentum, dull glaucous-grey on both sides, base narrowed into a stout petiole. Petiole 0—5 inch long. Flowers 25 inch diameter, yellowish-green, dioecious, in axillary clusters. Pedicels 0—2 inch long, deflexed. Calyx 15 inch long, tomentose. Corolla 2 inch long, stellately mealy outside; lobes reflexed. Berry 3—5 inch diameter, globose, red, smooth, closely girt by the enlarged somewhat leathery calyx.

Occurs in the vicinity of Pipalkoti in the Alakhnanda valley of North Garhwal. Here it is found growing in crevices in the bare rocks at 5,000 feet elevation, but it is not common. It has also been collected at Gangolihat in the Almora district. Flowers: April-May.

LXIV.—BIGNONIACEÆ.

Trees or shrubs, sometimes climbing, rarely herbs. Leaves opposite, rarely alternate or whorled, 1—3-pinnate, rarely simple, exstipular (in Indian genera). Flowers hermaphrodite, irregular, in racemes or panicles, often large and showy. Calyx spathaceous or 2—5-lobed. Corolla 2-lipped, tubular-ventricose; lobes 5, subequal. Stamens 4, didynamous, often with a fifth present but usually imperfect; inserted where the corolla-tube is suddenly swollen. Disk usually conspicuous. Ovary 2-celled (in Indian genera); ovules many; style long; stigma usually 2-lobed. Fruit an elongate 2-valved capsule, the valves separating from the often swollen axis, rarely indehiscent. Seeds prominently winged.

I.—Leaves 1-pinnate.

- | | | | |
|--------------------------------------|-----|-----|---------------------------|
| 1. A small shrub with trailing stems | ... | ... | 1. <i>Amphicome</i> . |
| 2. A tree | ... | ... | 2. <i>Stereospermum</i> . |

II.—Leaves 2-3-pinnate

...	...	3. <i>Orozyllum</i> .
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1. AMPHICOME, *Lindl.*

Herbs or undershrubs. Leaves alternate, simply pinnate; leaflets toothed. Calyx campanulate, truncate or 5-toothed. Corolla-tube elongate, widened upwards; lobes 5, entire, nearly equal. Stamens included; anther-cells with a tooth-like appendage near the base. Ovary subsessile. Capsule linear, smooth, loculicidally splitting on one side.

***Amphicome arguta*, Lindl.**—A small glabrous shrub with weak trailing stems 1—3 feet long which are usually herbaceous, but sometimes softly woody and attain 5 inch diameter. Young shoots pink. Leaves imparipinnate, 2·5—5 inches long. Leaflets 5—7, opposite or alternate; the terminal one 1·2 by 3—9 inch, lanceolate, gradually acuminate, sharply 1·2-serrate, base rounded or cuneate; the lateral one half to two-thirds the size of the terminal, base unequal-sided; all rather fleshy. Petiolule 0—1 inch long. Flowers in terminal lax racemes 4—8 inches long. Pedicels 3—8 inch long. Bracts 15—25 inch long, linear or lanceolate. Calyx campanulate, persistent; tube 2·3 inch long with 5 linear teeth 1—15 inch long. Corolla pink above and yellow below the constriction in the tube; tube 1·3—1·6 inches long, constricted below the middle; limb 6—8 inch across. Capsule 3—6 by 15—2 inch, slightly curved. Seeds oblong, about 1 inch long with a narrow membranous wing at each end terminating in long hairs.

Occurs along the main Himalayan range between 5,000 and 8,500 feet. Not very common, usually growing on precipitous rocks. Flowers: May—July. Fruit: September–October

2. STEREOSPERMUM, *Cham.*

Trees. Leaves opposite, imparipinnate; leaflets entire or toothed. Flowers in large lax terminal panicles. Calyx campanulate, truncate, or unequally 5-lobed. Corolla tubular-companulate. Stamens 4 with a rudimentary fifth, included. Style slender; stigmas 2. Disk cupular, fleshy. Fruit an elongate terete or 4-angled capsule, loculicidally 2-valved; septum thick corky cylindrical, pitted to contain the winged seeds.

Stereospermum suaveolens, DC. Vern. *Pādula* or *Pādeli*, Gen.—A medium-sized deciduous tree up to 7 feet girth and 60 feet high. Bark pale brown or grey, slightly rough. Blaze .5—7 inch, with coarse very short fibre, pale yellow or pale orange closely and uniformly striped with a darker shade. Young parts tomentose and glandular. Leaves 12—24 inches long. Leaflets 5—9, 3—6 by 2.3.5 inches, broadly elliptic, abruptly short-acuminate, entire, coriaceous, scabrid above and pubescent on the veins beneath when mature, base usually unequal, lateral nerves 8—12 pairs. Petiolules .1—3 inch long. Flowers fragrant, in lax drooping glandular-pubescent terminal panicles 9—18 inches long. Calyx .4-.5 inch long, viscidly hairy. Corolla 1.2—1.6 inches long, villous within on the lower side; lobes wrinkled; limb pinkish, tube brownish on one side, pale yellowish on the other, the central portion of the lower lip yellow. Capsule 12—24 inches long by .5—7 inch diameter, cylindric but somewhat angled, brown densely covered with elevated pale specks. Seeds 1.5 by .3 inch, including the membranous wing at each end.

Occurs throughout the area up to 4,500 feet. Fairly common in open dry miscellaneous and *sal* forests, especially in grassy areas. Flowers: May-June. Fruit: April-May.

3. OROXYLUM, *Vent.*

Small trees. Leaves large, opposite, pinnately compound; leaflets entire. Flowers large, in long terminal racemes. Calyx campanulate, coriaceous; limb truncate or obscurely toothed. Corolla large, fleshy, campanulate; lobes 5, subequal. Stamens 5, perfect, somewhat exerted. Disk large. Ovary compressed; stigma 2-lobed. Fruit a very large septically 2-valved capsule, compressed parallel to the septum.

Oroxylum indicum, Vent. Vern. *Tantia*, G. *Pharkat*, A.—A small deciduous tree up to 4 feet girth and 40 feet high. Bark pale grey with silvery portions, smooth, sometimes thinly corky. Blaze .5—1 inch, soft, fibrous towards the interior, bright yellow usually tinged with chlorophyll towards the exterior. Leaves 2—4 feet long, clustered towards the ends of the branches, 2-3-pinnate. Petiole and rachis with

small raised lenticels. Pinnae opposite, 3-4 pairs, the 2-3 lower pairs bipinnate at the base. Pinnules 3-5-foliolate. Leaflets 2·5-5 by 1·5-4 inches, broadly ovate or elliptic, acuminate, base rounded, glabrous. Petiolules of the lateral leaflets 2-6 inch long. Flowers 2-3 inches diameter, purple, fleshy, foetid, in large, erect, terminal, pedunculate, unilateral racemes. Peduncle 2-3 feet long, stout, hollow. Pedicels 2-1·2 inches long. Calyx 1 inch long, coriaceous, persistent. Corolla up to 4 inches long, campanulate with 5 rounded lobes. Capsule a flattened, rigid, reddish-brown, curved, almost woody pod 1-2·5 feet long by 2·5-3·5 inches broad. Seeds numerous, flat, winged all round except the base, 2-3 inches across the wing.

Occurs throughout the subhimalayan tract and central and outer hill ranges up to 3,000 feet. Not uncommon in open miscellaneous forests. The leaves turn purplish before falling. Flowers: June-July. Fruit: January-March.



LXV.—ACANTHACEÆ.

Herbs or shrubs, rarely trees. Leaves usually opposite and entire, often furnished with linear cystoliths which appear as translucent marks in fresh leaves and as raised lines (leaves lineolate) in dried leaves, exstipulate. Flowers hermaphrodite, irregular, in cymes racemes or spikes, rarely solitary. Calyx 5-partite (in *Thunbergia* of several small teeth). Corolla 2-lipped or subequally 5-lobed. Stamens 4 or 2, inserted on the corolla-tube, sometimes a staminode fifth. Disk usually conspicuous. Ovary superior, 2-celled; ovules 1-many in each cell; style simple; stigma usually 2-lobed. Fruit a loculicidal capsule, valves often elastically recurved, the septum splitting. Seeds usually hard and attached to upcurved supports (retinacula), often clothed with elastic hairs which spread out when wetted.

I.—A large climber 1. *Thunbergia*.

II.—Shrubs, erect or suberect, not climbing.

A. Calyx of 4 sepals, the outer pair the largest ... 2. *Barleria*.

B. Calyx 5-partite

1. Corolla-lobes subequal.

(a) Stamens 2 3. *Dædalacanthus*.

(b) Stamens 4.

* Ovules or seeds 4.

(i) Corolla-lobes twisted to the left in bud.

† Bracteoles very large, reticulate ... 4. *Petalidium*.

†† Bracteoles linear or 0 ... 5. *Strobilanthes*.

(ii) Corolla-lobes imbricate in bud ... 6. *Asystasia*.

** Ovules or seeds more than 4 ... 7. *Aechmanthera*.

2. Corolla distinctly 2-lipped.

(a) Corolla orange or buff ... 8. *Phlogacanthus*.

(b) Corolla white often with purplish spots or lines on the lips.

* Corolla less than .75 inch long ... 9. *Lepidagathis*.

** Corolla more than .75 inch long ... 10. *Adhatoda*.

(c) Corolla purplish-red or pink with spots or veins on the lips.

* Corolla more than 1 inch long ... 11. *Peristrophe*.

** Corolla less than 1 inch long.

(i) Corolla purplish-red with a white branched vein on the lip ... 12. *Justicia*.

(ii) Corolla pink with a few purple spots on the lip ... 13. *Dicliptera*.

1. THUNBERGIA, *Linn. f.*

Climbers, rarely erect. Leaves opposite. Flowers axillary or in racemes; bracts at the base of the pedicels leaf-like; bracteoles large, enclosing the flower-buds.* Calyx small, annular, usually 10—16-toothed. Corolla-tube ventricose, curved; limb oblique; lobes 5, twisted to the left in bud. Stamens 4, didynamous; anther-cells sometimes spurred. Disk conspicuous. Ovules 2 in each cell. Fruit a globose capsule with a flat hard sword-shaped beak. Seeds 4, glabrous.

Thunbergia coccinea, *Wall.*—A profusely-branched climber with dextrorse stems up to 2 inches diameter and 45 feet high. Bark pale brown, roughish, with conspicuous raised lenticels sometimes arranged in longitudinal lines. Blaze 1·2 inch, not fibrous, whitish or greenish. Twigs smooth, green, hollow, glabrous or nearly so. Leaves 3—6 by 1·5—3 inches, ovate-oblong or ovate-lanceolate, acute or acuminate, base cordate or rounded, margin more or less sinuate or sometimes obscurely blunt-toothed, glabrous above, glabrous or glabrescent beneath; basal nerves 5—7, prominent beneath. Petiole 7—2·5 inches long, dilated towards the base, glabrous or with a few hairs near the top. Flowers 7—1·1 inches long, arranged in rows 2—5 together in the axils of bracts along the rachis of axillary and terminal drooping racemes 3—8 inches long. Pedicels 25—6 inch long. Bracts leaf-like passing towards the base of the inflorescence into sessile leaves. Bracteoles 5—9 inch long, ovate, purplish, more or less cohering on one side, subpersistent. Calyx white, consisting of a narrow 5-toothed rim. Corolla-tube bright yellow tinged with red outside, the reflexed lobes carmine. Capsule 1—1·5 inches long, the globose basal portion 7·8 inch diameter.

Occurs along the subhimalayan tract and outer hill ranges between 1,000 and 3,000 feet. Appears to be scarce. Generally found in shady ravines and moist localities. Flowers: December—February.

2. BARLERIA, *Linn.*

Shrubs or herbs, often spinescent. Leaves opposite, entire, usually lineolate. Flowers showy, usually in spikes. Calyx 4-partite, the lobes in opposite pairs, the outer pair the larger, anterior lobe often 2-fid. Corolla with elongate tube, funnel-shaped upwards; lobes 5, subequal, imbricate in bud. Stamens 2 perfect, 2 rudimentary and often a rudimentary fifth. Disk large, often cupular. Ovules 2 in each cell; style long. Fruit an ovoid or oblong capsule, 2- or 4-seeded below the middle. Seeds usually hairy.

I.—Armed with sharp spines. Flowers orange-yellow ... 1. *Prionitis*.

II.—Unarmed. Flowers blue or rose-coloured.

- | | | | | |
|---|-----|-----|-----|----------------------|
| 1. Leaves 1—5 inches long. Outer sepals pectinately toothed | ... | ... | ... | 2. <i>cristata</i> . |
| 2. Leaves 5—11 inches long. Outer sepals entire | | | | 3. <i>strigosa</i> . |

1. *Barleria Prionitis*, Linn.—A shrub 2—5 feet high, much branched, usually armed with spines (modified bracts) which are straight, slender or flattened, sharp, pale grey or whitish and usually about .5 inch long. Leaves variable in size, 1.5—4 inches long, elliptic, acuminate at both ends, cuspidate, glabrous or more or less pubescent beneath especially when young; lateral nerves 4-5 pairs. Petiole .5—1 inch long or 0 in the upper leaves. Flowers 1 inch diameter, orange-yellow, solitary in the lower axils becoming spicate above. Bracts .5—1 inch long, elliptic or linear-oblong, foliaceous, cuspidate. Bracteoles .3—1 inch long, spinous. Calyx-lobes .4-.5 inch long, outer elliptic-oblong, inner linear, cuspidate. Corolla 1—1.5 inches long, pubescent outside; limb as long as the tube, somewhat 2-lipped. Capsule .5—1 inch long, with a solid beak, glabrous.

There is a single sheet of this species at Dehra Dun collected by Colonel Davidson in the Kosi valley and Mr. H. G. Champion informs me that it is found, though rare, in the Ranikhet Division. According to Duthie this species is common in the plains adjoining our area and is sometimes used as a hedge plant. Flowers: October—January.

2. *Barleria cristata*, Linn.—A deciduous or subdeciduous shrub with usually erect sometimes prostrate stems 1—5 feet high and up to .6 inch diameter. Bark pale brown, slightly rough. Leaves very variable both in size and shape, 1—5 by .4—1.5 inches, elliptic elliptic-oblong or lanceolate, acute or acuminate, base narrowed into the petiole, more or less adpressed-hairy on both surfaces especially on the nerves beneath; lateral nerves 4—6 pairs. Petiole up to .5 inch long. Flowers .7—1 inch across, pale violet-blue to rose colour, in axillary and terminal short spikes. Bracts 0. Bracteoles .2—1 inch long, linear-lanceolate. Calyx cleft nearly to the base; outer lobes .5—1 inch long, elliptic, pectinately-toothed, the spinulose teeth tipped by a hair, strongly nerved and leaf-like, persistent and scarious in fruit; inner lobes .2-.3 inch long, linear-lanceolate. Corolla 1—1.5 inches long, pubescent outside; tube about as long as the limb. Capsule .5-.6 inch long, glabrous.

Occurs throughout the area up to 5,000 feet. Common in dry places. The plant is very variable in habit sometimes producing annual shoots from a woody rootstock and sometimes forming a woody stem up to 5 feet high. I suspect two species may be included in the above description, namely, a larger plant with blue flowers and a smaller plant with rose-coloured flowers found generally at higher elevations. Flowers: October–November. Fruit: December–January.

3. *Barleria strigosa*, Willd.—An erect shrub 2—6 feet high with stems up to .5 inch diameter. Bark smooth, pale brown. Leaves 5—11 by 2.5—4.5 inches, elliptic-ovate or elliptic, acute or acuminate, base narrowed and decurrent on the petiole, sparsely adpressed-hairy on both surfaces chiefly on the nerves, dull or slightly glossy above, pale beneath; lateral nerves 5—7 pairs, arcuate, prominent and often tinged purple beneath. Petiole 0—1 inch long below the winged portion.

Flowers 1·3—1·5 inches diameter, blue, in compact, bracteolate, one-sided, densely adpressed-hairy, terminal and axillary spikes 1—1·5 inches long. Bracteoles 4—7 inch long, lanceolate. Calyx rather densely adpressed-hairy; outer sepals imbricate in a row, 8—1·2 inches long, ovate, green, persistent, with prominent violet-tinged nerves; inner 3 inch long, linear, acute. Corolla 1·5—2 inches long, glandular-hairy outside. Capsule 7·8 inch long, glabrous.

Occurs in the subhimalayan tract and outer hill ranges between 1,000 and 4,000 feet. Fairly common in shady forest and ravines. Flowers: November—January.

3. DÆDALACANTHUS, *T. Anders.*

Shrubs or undershrubs, rarely herbs. Leaves opposite, entire or obscurely toothed, lineolate. Flowers usually showy, in spikes, heads or corymbs. Bracts usually large. Calyx-lobes narrow. Corolla with slender tube, widened only near the mouth, lobes twisted to the left in bud. Stamens 2, glabrous. Ovules 2 in each cell. Style long; stigma simple, linear. Fruit a clavate capsule. Seeds compressed, hairy.

Daedalacanthus nervosus, *T. Anders.*—A small evergreen shrub with erect stems 2—6 feet high and up to 75 inch diameter, often only herbaceous but ultimately woody. Bark pale, quite smooth, papery. Leaves 6—12 by 2·5—5 inches, elliptic or ovate, acuminate, cuneately attenuated into the petiole, entire, glabrous or pubescent on the nerves; lateral nerves 7—12 pairs, conspicuous, arcuate. Petiole 5—1·5 inches long. Flowers 7—1 inch diameter, blue, in erect axillary and terminal dense spikes 1—3 inches long; terminal spikes paniced, the axillary solitary. Bracts 5—75 inch long, obovate, cuspidate, glabrous or minutely pubescent, whitish with green veins. Calyx 25—35 inch long. Corolla 1—1·25 inches long; tube cylindric, narrow, widened near the top; limb spreading. Capsule 6 inch long, glabrous. Seeds normally 4.

Occurs throughout the area up to 4,000 feet. Fairly common in moist shady places. Flowers: March-April. Fruit: April-May.

4. PETALIDIUM, *Nees.*

Shrubs or undershrubs. Leaves opposite, entire or toothed. Flowers in contracted axillary cymes or racemes, often crowded on shortened lateral branchlets, sometimes reduced to a single flower; bracts narrow or absent; bracteoles large. Calyx 5-partite; lobes unequal, narrow. Corolla ventricose straight or curved; lobes 5, subequal. Stamens 4, didynamous. Ovules 2 in each cell; style long; stigma with 2 unequal lobes. Fruit a clavate compressed capsule. Seeds 2 or 4, hairy.

Petalidium barlerioides, *Nees*.—A deciduous or subdeciduous shrub with weak, straggling rarely subscandent stems up to 12 feet high and 1·5 inches diameter, with much swollen nodes. Bark fairly smooth, pale brown. Twigs obscurely 4-angled with a large pith. Leaves 3·5—7 by 2—4 inches, ovate or elliptic, acuminate, entire, base obtuse or rounded abruptly narrowed and produced as a narrow wing to the petiole, glabrous above, sparsely clothed with minute hairs beneath, lateral nerves 6—11 pairs, conspicuous beneath. Petiole 75—4 inches long. Flowers solitary, the tube half-hidden by two green leaflike bracteoles, terminating axillary peduncles 2—6 inch long which are arranged in a spike-like inflorescence. Bracteoles 7—1 inch long, strongly nerved, ovate, acute, scarious in fruit. Leaves of the inflorescence about 1 inch long at the time of flowering. Calyx glandular-hairy without; lobes linear-lanceolate, 3—6 inch long. Corolla tubular-ventricose, 1·3—1·5 inches long, white, the tube pinkish-brown inside with reflexed fulvous hairs. Capsule 5·6 inch long, glabrous, cuspidate.

• Occurs throughout the subhimalayan tract and outer hill ranges up to 3,000 feet, rarely penetrating to the central ranges. Fairly common along the base of the hills, especially on steep banks bordering "nalas." Flowers: March—May.

5. STROBILANTHES, *Blume*.

Shrubs undershrubs or herbs, often gregarious, sometimes only flowering periodically and then dying. Leaves opposite, often unequal, toothed or subentire, usually lineolate. Flowers spicate, capitate or paniced, usually with 1 floral bract and 2 bracteoles. Calyx deeply 5-fid, lobes narrow, one often longer. Corolla tubular-ventricose, straight or curved; lobes 5, rounded. Stamens usually 4 didynamous, rarely 2. Disk small or prominent. Ovules 2 in each cell; style linear; stigma of one linear-lanceolate lobe, the other obsolete. Fruit a 2- or 4-seeded capsule. Seeds compressed, glabrous or hairy.

I.—Bracts densely imbricate forming strobiliform spikes 1. *auriculatus*.

II.—Bracts not imbricate.

A. Twigs distinctly but narrowly winged ... 2. *quadrangularis*.

B. Twigs not or very obscurely winged.

1. Leaf-base usually cordate ... 3. *alatus*.

2. Leaf-base narrowed, never cordate.

(a) Leaves softly hairy on both surfaces ... 4. *glutinosus*.

(b) Leaves glabrous or puberulous.

* Flowers mostly in pedunculate few-flowered heads.

(i) Bracts pubescent ... 5. *angustifrons*.

(ii) Bracts glabrous ... 6. *Dalhousianus*.

** Flowers in pairs arranged in one-sided spikes.

- (i) Annual shoots produced at the ends of
a much-branched tall woody stem.
Flowers pale violet 7. *Wallichii*.
- (ii) Annual shoots tall erect and unbranched
and produced from close to the ground.
Flowers dark violet 8. *atropurpureus*.

1. *Strobilanthes auriculatus*, Nees.—A deciduous shrub 1—3 feet high with softly woody suberect straggling stems up to .5 inch diameter. Bark pale brown. Twigs quadrangular, glabrous or nearly so. Leaves often unequal in the same pair, the larger 5—10 by 1.5—3 inches, oblong-lanceolate, acuminate, base narrowed and again widening into an ear-like expansion, serrulate, thin, sparsely hairy above and puberulous on the nerves beneath, somewhat scabrous; lateral nerves 10—14 pairs, arcuate. Petiole 0. Flowers .5 inch diameter, pale or dark violet, in compact strobiliform axillary and terminal spikes 1.5—4 inches long and quadrangular in cross-section. Bracts green, densely imbricate, .2-.3 inch long, obovate, obtuse, densely pubescent and (var. *Edgeworthiana*) with long white ciliate hairs, glandular. Calyx .2-.3 inch long with ligulate pubescent and (var. *Edgeworthiana*) ciliate lobes. Corolla 1 inch long with a double dark line along the palate inside, nearly straight, puberulous without. Capsule .3-.4 inch long, glabrous. Seeds hairy.

The type occurs throughout the subhimalayan tract and outer hill ranges between 1,000 and 2,000 feet usually in shady forest, but it is not very common. According to Mr. H. H. Haines it flowers periodically at intervals of about 6 years. I have also found var. *Edgeworthiana* on the outer hill ranges between 2,500 and 5,000 feet. Flowers: November—March. Fruit: April-May.

2. *Strobilanthes quadrangularis*, Clarke.—A deciduous shrub with erect stems 1-2.5 feet high, only the basal portion up to 6 inches above the ground persisting and becoming somewhat woody. Twigs pubescent, quadrangular and narrowly winged. Leaves 6—12 by 2.5—5 inches, elliptic, acuminate, serrate, base cuneate and narrowed to form a wing to the petiole, sparsely clothed on both surfaces but especially on the nerves with short stout hairs; lateral nerves 11—13 pairs, arcuate. Petiole 0—1 inch long, usually 0. Flowers .5-.6 inch diameter, deep purple, in few-flowered pedunculate terminal and axillary heads. Peduncles 1—3 inches long, often with opposite branches, puberulous. Bracts ovate, acute, pubescent, caducous. Bracteoles 0. Calyx with 5 unequal spatulate lobes .25—.5 inch long, densely glandular-hairy outside. Corolla 1-1.5 inches long, pubescent without. Capsule .5-.6 inch long, glandular-pubescent.

Occurs along the slopes of the main Himalayan range between 6,000 and 8,500 feet. Appears to be local in its distribution, but is abundant and gregarious in some localities. It is found in forest. Flowers: August—October. Fruit: November.

3. *Strobilanthes alatus*, Nees.—An erect deciduous shrub 1—3 feet high of which only the basal portion up to 6 inches above the ground

persists and is somewhat woody. Twigs more or less quadrangular, clothed with downwardly directed pale hairs, glandular or not. Leaves 4—7 by 2-3·5 inches, ovate, caudate-acuminate, base cordate or broadly rounded (rarely narrowed abruptly and confluent with the wings of the petiole), crenate-serrate, membranous, persistently pubescent or glabrescent when mature; lateral nerves 8—11 pairs of which the lowest 3-4 pairs arise within ·5 inch from the base of the midrib. Petiole 1—5 inches long or 0 in the upper leaves, narrowly winged throughout or at least near the top. Flowers ·7 inch diameter, deep violet-blue, in interrupted viscous-hairy usually paniced spikes which soon lengthen out. Bracts lanceolate or oblong, caducous. Bracteoles ·2 inch long, caducous. Calyx ·3 inch long; lobes ligulate, glandular-hairy, one larger than the others. Corolla 1·3—1·5 inches long, paler coloured towards the base, hairy without, keeled on one side. Capsule ·6-·7 inch long, glandular-hairy or glabrescent. Seeds hairy.

Occurs throughout the hills between 5,000 and 8,000 feet. Very common and somewhat gregarious, chiefly in oak forest. Flowers: August—October. Fruit: October—November.

4. *Strobilanthes glutinosus*, Nees.—An evergreen or deciduous shrub 2—4 feet high with stems up to 1 inch diameter, swollen at the nodes. Bark smooth, pale yellowish-brown. Twigs sometimes obscurely quadrangular, tomentose but only glandular in the region of the inflorescence. Leaves often unequal in the same pair, the larger 4·5—9 by 1·5—3 inches, elliptic, acuminate, base cuneate and usually narrowed to form a short wing to the petiole, crenate-serrate, dull green above, clothed with soft rather dense eglandular hairs on both surfaces; lateral nerves 7—12 pairs, arcuate, much impressed above and raised beneath. Petiole ·3—3 inches long, tomentose. Flowers 1·2—1·5 inches diameter, solitary in the axils of bract-like leaves or the upper in short capitate spikes. Bracts ·3 inch long, ovate; bracteoles ·2-·3 inch long, ligulate; both densely hairy and viscid. Calyx ·3—·5 inch long with linear viscous-hairy lobes. Corolla 1·75—2·1 inches long, pale lilac or pale blue with a purple branched vein along the palate inside, the lower half of the tube white. Capsule ·6—·8 inch long, glandular-hairy. Seeds hairy.

Occurs throughout the hills between 2,000 and 7,000 feet. Common and often somewhat gregarious in moist and shady forest, most commonly associated with *banj*. The leaves are usually not aromatic when crushed, rarely slightly so. Flowers: November—March. Fruit: March—April.

5. *Strobilanthes angustifrons*, Clarke. Vern. *Patheura* or *Patoti*, NG.—An evergreen or subdeciduous shrub usually 3-4 but occasionally 6 feet high with stems up to 1 inch diameter, often weak and supported by surrounding vegetation. Bark fairly smooth, pale brown. Twigs

more or less quadrangular, glabrous. Leaves 3—8 by 1.25—3 inches, elliptic, elliptic-ovate or lanceolate, acuminate, base rather abruptly narrowed to form a short wing to the petiole, serrate, puberulous above, glabrous or puberulous beneath, ciliate; lateral nerves 6—9 pairs, arcuate. Petiole 0—2 inches long, winged upwards. Flowers .7 inch diameter, pale bluish-purple, in lateral and terminal panicle spikes; the spikes often head-like, pedunculate. Bracts: the upper .4 inch long, ovate, pubescent, caducous; the lower foliaceous, persistent. Bracteoles .2 inch long, caducous. Calyx .3—5 inch long with linear glandular-pubescent lobes. Corolla 1.5—2 inches long, nearly straight, glandular-hairy without. Capsule .3—5 inch long, sparsely glandular-pubescent. Seeds hairy.

Occurs throughout the hills between 2,000 and 7,000 feet. Common in secondary miscellaneous forest and open scrub, not noticeably gregarious. Flowers: September—December.

6. *Strobilanthes Dalhousianus*, Clarke.—A subdeciduous shrub, usually 2-3 feet high but occasionally up to 5 feet, the greater portion of the stem persistent and attaining .5 inch diameter, sometimes more or less procumbent and rooting at the nodes. Bark fairly smooth, lenticellate. Twigs more or less quadrangular, glabrous or with pale spreading hairs. Leaves variable in size, usually 4.5—11 by 1.75—3.5 inches, elliptic, acuminate, serrate, base gradually narrowed to form a wing to the petiole, glabrous or puberulous on both or only one side, sometimes puberulous only on the nerves, dull green above, pale beneath; lateral nerves 7—12 pairs, arcuate, prominent on both surfaces, raised above. Petiole 0—5 inch long. Flowers .6—1.2 inches diameter, violet purple or mauve, rarely white, in heads or very short pedunculate spikes. Bracts .2—5 inch long, orbicular, concave, glabrous, caducous. Bracteoles similar to the bracts but smaller. Calyx-lobes ligulate, .3 inch long except one which is longer, puberulous or densely glandular-hairy outside. Corolla 1.2—2 inches long, the lower half of the tube paler coloured and curved, glabrous outside. Capsule .5-.6 inch long, glabrous. Seeds hairy.

Occurs throughout the hills between 4,500 and 7,000 feet. Very common and often gregarious in oak forests, especially in moist shady ravines. I have united *S. Dalhousianus* and *S. pentstemonoides*, T. Anders. in the above description as the distinctions given by C. B. Clarke in the F. B. I. which are mainly based on relative hairiness of the leaves and calyx appear to pass into one another. I have found both growing together and both occupy approximately the same range of elevation. In the F. B. I. the stamens are shown as glabrous; in all the specimens I have examined I have found them hairy. Flowers: August—November.

7. *Strobilanthes Wallichii*, Nees. Vern. *Jimla* or *Jānu*, NG.—A deciduous much-branched shrub usually 3—6 feet high but occasionally up to 10 feet with a perennial woody stem up to 8 feet high and 1.5

inches diameter. Bark pale yellowish-brown, fairly smooth, lenticellate. Nodes more or less swollen. Twigs quadrangular, not or very obscurely winged. Leaves on flowering shoots 1·5-6 by ·7—2 inches, elliptic-oblong, caudate-acuminate, narrowed into a long winged petiole, serrate or crenate-serrate, thin, membranous, with scattered short hairs on both surfaces, especially along the nerves and leaf-margin; lateral nerves 6—8 pairs, arcuate. Petiole up to 2 inches long or the upper leaves sessile. Flowers ·6—·8 inch diameter, pale purple or pale violet, in pairs arranged in lax terminal and axillary one-sided spikes. Bracts foliaceous, variable in size. Bracteoles small or 0. Calyx with 5 ligulate glabrous or glandular-hairy lobes ·4-·5 inch long in flower lengthening to nearly twice this in fruit. Corolla 1—1·5 inches long, the tube bent in the middle of its widest portion, glabrous or sparsely glandular-hairy outside. Capsule ·5—·7 inch long, glabrous or glandular-hairy. Seeds hairy.

Occurs in the central and interior ranges between 7,000 and 9,500 feet. Common and very gregarious, often in forests of *Abies Webbiana*, *Quercus dilatata* and *Quercus semicarpifolia* and usually on north aspects. The growth of this species is often very dense and covers many square miles. Until the year of flowering takes place this species has little or no smell, but when it flowers the whole plant becomes very aromatic and gives off a strong musk-like scent which becomes still further intensified as the fruit ripens in the autumn at which season it can be detected with a favourable wind at a distance of half a mile. This peculiarity is shared in common with *S. atropurpureus*, Nees, and it may be presumed that the strong scent is intended to prevent sheep and goats from destroying the seed as these two species are a valuable fodder and suffer much from browsing. Flowering takes place periodically, probably at intervals of 12 years, the flowers appearing in August and September. I found it flowering gregariously around Marban in Malla Chandpur and again all round Pandukeshwar, both in North Garhwal, in 1918.

8. *Strobilanthes atropurpureus*, Nees.—An undershrub with a perennial stout woody rootstock which is sometimes raised 2—4 inches above the ground surface and produces erect, unbranched, quadrangular, annual, herbaceous stems 2—7 feet high and ·3—·5 inch diameter, which show a tendency to become winged in the region of the inflorescence. Stems much swollen just above each node, and when the stems are coloured pink or red as is often the case there is a conspicuous whitish band across the swelled portion. Leaves on sterile shoots up to 11 by 4·5 inches, elliptic-oblong, caudate-acuminate, crenate-serrate, base narrowed into a long winged petiole, lateral nerves 8—15 pairs, arcuate; on flowering shoots 2—5 by 1—1·5 inches, ovate or ovate-lanceolate, base more abruptly narrowed into the much shorter winged petiole, with scattered short hairs on both surfaces, especially along the nerves and leaf-margin. Petiole up to 2 inches long or the upper leaves sessile. Flowers 1—1·25 inches diameter, deep violet or dark purple, rarely white, in pairs arranged in lax terminal and axillary one-sided spikes. Bracts foliaceous, variable in size, the lower indistinguishable from the

leaves. Bracteoles small or 0. Calyx with 5 ligulate glabrous or glandular-hairy lobes, .5-.6 inch long in flower, lengthening to nearly twice this in fruit. Corolla 1—1.5 inches long, the tube bent in the middle of its widest portion, glabrous outside. Capsule .5—1 inch long, glabrous. Seeds hairy.

Occurs on the central and interior ranges between 7,500 and 10,500 feet. Common and very gregarious but local; often in mixed deciduous forest, usually on north aspects. Flowering probably at intervals of 12 years, the flowers appearing from June to August. Fruit: October.

6. *ASYSTASIA*, *Blume*.

Herbs or undershrubs. Leaves opposite, usually entire. Flowers in lax or dense, usually secund, simple or compound, spikes or racemes. Bracts and bracteoles usually small. Calyx 5-partite; lobes narrow. Corolla-tube cylindric below, inflated above; lobes 5. Stamens 4, didynamous, perfect. Ovary hairy; ovules 2 in each cell; style linear, stigma 2-fid or subcapitate. Fruit an elliptic capsule with contracted solid base. Seeds 4, compressed, glabrous.

***Asystasia macrocarpa*, *Nees*.**—An evergreen shrub with weak rambling or trailing stems up to 12 feet high and 1 inch diameter. Bark pale yellowish-brown, smooth. Blaze .1 inch or less, green with a viscous slimy juice. Twigs smooth, green, striate, with a large pith. Leaves variable in size, mostly 5—9 by 1.5—3.5 inches, entire, elliptic or ovate, acuminate, base narrowed and decurrent on the petiole, hairy on both surfaces when young, glabrous or glabrescent above and sparsely hairy beneath when mature; lateral nerves 7—10 pairs, arcuate, prominent beneath; those towards the ends of the branches often smaller, sessile and narrowly lanceolate. Petiole .5—3 inches long. Flowers .75 inch diameter, dull pink or pinkish-mauve, in lax one-sided axillary and terminal racemes 1—5 inches long. Bracts lanceolate .1—2.5 inch long. Pedicels up to .2 inch long. Calyx .2-.3 inch long; tinged purple and clothed with short glandular hairs. Corolla 1.2—1.5 inches long, glandular-pubescent outside, with reflexed hairs in the constricted portion of the tube inside. Capsule 1.3—1.4 inches long, the basal two-thirds contracted and seedless, glandular-hairy.

Occurs throughout the subhimalayan tract and outer hill ranges between 1,000 and 3,000 feet. Rather scarce, usually in ravines and on the banks of watercourses. Flowers: January—April.

7. *ÆCHMANTHERA*, *Nees*.

Shrubs. Leaves opposite, crenate. Flowers in sessile clusters arranged in a trichotomous or secund panicle; bracts and bracteoles linear. Calyx 5-partite; lobes linear. Corolla-tube cylindric at the base, suddenly widened near the middle; lobes 5, rounded. Stamens 4,

didynamous. Ovary densely hairy at the apex; ovules 4—6 in each cell; stigma large, simple. Fruit a narrow, oblong, 6—8 (sometimes 12) seeded capsule. Seeds compressed, hairy or glabrous.

Aechmanthera tomentosa, Nees. Verr. *Bairāra*, NG. *Janila*, A.—An erect subdeciduous shrub 2—6 feet high with stems up to 2½ inches diameter. Stems and leaves clothed with long, spreading, jointed, capitate hairs, the stems often clothed in addition with a dense white felted tomentum, ultimately deciduous. Twigs quadrangular with a large pith. Blaze 25—35 inch, soft, shortly fibrous, pale yellow turning green on exposure. Leaves 3½—7 by 2—4 inches, ovate or oblong-lanceolate, acute or shortly acuminate, base rounded or cordate, crenulate, softly tomentose on both surfaces, lateral nerves 12—16 pairs, all nerves deeply impressed above giving a rugose appearance. Petiole 5—3½ inches long. Flowers 7-8 inch diameter, deep violet or dark purple, in 4—8-flowered clusters on the spreading branches of an open terminal leafy panicle. Bracts 4—8 inch long, ligulate, glandular-hairy. Calyx 4 inch long, glandular-hairy. Corolla 7—1 inch long, tubular-ventricose, glabrous or pubescent without, with 2 hairy lines on the palate within. Capsule linear, pubescent, about as long as the calyx.

Occurs throughout the hills between 3,000 and 7,000 feet. Very common and gregarious in many types of forest, but especially in *chir* forests. At higher elevations the stems are usually annual and 1-2 feet high. The leaves turn varying shades of purple before falling. Flowers: August—October at intervals of several years, and plants flower sporadically nearly every year as well. The description given above includes the typical form as well as variety *Wallichii*. The latter is separated on account of its dense woolly tomentum and the ex-current connective, but I do not find these distinctions coincide with any well-marked field characters.

8. PHLOGACANTHUS, Nees.

Shrubs or herbs. Leaves opposite, usually entire. Flowers in thyrses or narrow panicles, rarely simple racemose or in axillary cymes. Bracts small; bracteoles small or absent. Calyx 5-partite, lobes narrow. Corolla tubular, curved; limb oblique, 2-lipped. Stamens 2 and sometimes 2 small staminodes. Ovules 5—8 in each cell; stigma pointed. Fruit an elongate many-seeded capsule. Seeds glabrous or hairy.

Flowers in dense terminal or subterminal spiciform	
panicles 	1. <i>thyrsiflorus</i> .
Flowers axillary, solitary or in 2—4-flowered cymes	2. <i>sp.</i>

1. Phlogacanthus thyrsiflorus, Nees. Vern. *Kaldōna* or *Kawadōni*, SG. and R.—An evergreen or subdeciduous shrub 6—12 feet high with stems up to 3 inches diameter. Bark pale brown, slightly rough, mealy-corky. Blaze 1-2 inch, white or pale yellow. Twigs pale often whitish, with large pith. Young shoots quadrangular and narrowly

winged or with raised ridges at the angles. Leaves 7—15 by 1·75—4 inches, oblanceolate oblong-lanceolate or -elliptic, entire, acuminate usually caudate, base cuneate, glabrous, very dark glossy green above, pale and glaucescent beneath; lateral nerves 8—12 pairs, arcuate. Petiole ·8—2·5 inches long. Flowers orange-red, in dense spike-like densely pubescent panicles 4—12 inches long; spikes terminal or sub-terminal, usually solitary. Bracts ·3—·7 inch long, linear, densely pubescent. Pedicels ·05—·2 inch long. Calyx ·3·4 inch long; lobes linear, setaceous. Pedicels and calyx clothed outside with purplish-brown pubescence. Corolla ·5—·8 inch long, villous. Filaments yellow. Anthers purple. Capsule 1—1·2 inches long, sub-quadrangular.

Occurs throughout the subhimalayan tract and outer hill ranges between 1,000 and 3,000 feet. Common in the Bhabar in ravines and dense moist forest. Flowers: March-April. Fruit: April—June.

2. Phlogacanthus, sp.—A subdeciduous shrub 6—10 feet high. Leaves 5—8 by 2—4 inches, elliptic, acuminate, entire, base narrowed to form a short wing to the petiole, clothed on both surfaces with dense short velvety pubescence when young, glabrescent when mature, lateral nerves 7—9 pairs, arcuate. Petiole up to 1 inch long. Flowers ·5 inch long, orange or buff with dark purple veins, solitary or 2—4 together in short axillary cymes up to ·5 inch long. Pedicels ·15—·25 inch long. Calyx cleft almost to the base; the 5 lobes narrowly oblong, acuminate, ·3·4 inch long. Pedicels and calyx clothed both inside and out with short close velvety pubescence. Corolla rather densely puberulous and glandular outside, tubular-inflated nearly from the base; limb small with ovate erect segments. Stamens glabrous, curved and protruding about ·25 inch beyond the corolla. Capsule elongate, ·8—1·2 inches long, glabrous. Seeds 8, pubescent.

The species described above has been collected by Mr. W. J. Lambert near Baram at about 2,500 feet elevation in the Gori valley, East Almora, and by Mr. H. G. Champion at Pipalkot in the Haldwani Division at 4,500 feet elevation. Flowers: February. Fruit: March.

This species differs from *P. pubinervius*, T. Anders. in possessing larger leaves and fewer-flowered cymes (2—10-flowered in *P. pubinervius*). The calyx-teeth are longer and are velvety-pubescent on the outside as are also the pedicels, whilst these parts are glabrous or nearly so in true *pubinervius*.

9. LEPIDAGATHIS, Willd.

Herbs or undershrubs. Leaves entire, crenate or serrate, usually lineolate. Flowers sessile, usually in dense bracteate usually secund often fascicled spikes or heads; bracts usually conspicuous, bracteoles narrower. Calyx deeply 5-lobed; lobes unequal, the two anterior more or less connate. Corolla-tube cylindric below, suddenly expanding and

2-lipped above, upper lip 2-fid, the lower 3-lobed. Stamens 4, didynamous. Ovules 2 in each cell; stigma capitellate, shortly 2-lobed or entire. Fruit a conoid or oblong 2—4-seeded capsule. Seeds hairy.

I.—Bracts terminating in a sharp spine. Stems often exceeding .25 inch diameter. Spikes 4-fariously symmetrical ... 1. *cuspidata*.

II.—Bracts not spinous. Stems not exceeding .25 inch diameter. Spikes unilateral.

1. Stems usually dark purplish. Corolla spotted on the mid-lobe of the lower lip only ... 2. *purpuricaulis*.
2. Stems pale or whitish. Corolla spotted on both lips ... 3. *hyalina*.

1. **Lepidagathis cuspidata**, Nees.—A small deciduous shrub with rather stiff branches, the stems 1—3 feet high and up to .75 inch diameter. Bark pale brown and ultimately somewhat corky, silvery-grey or whitish on the branches. Young shoots glandular-hairy. Leaves variable, the lower 4—8 by 1.25—2.5 inches, ovate, acuminate, mucronate, entire, base abruptly narrowed and produced as a narrow wing to the petiole, slightly pubescent, lateral nerves 7-8 pairs arcuate; the upper much smaller, often only .5 inch long, elliptic, glandular-pubescent, passing gradually into the bracts. Flowers .4-.5 inch long, dull white spotted with purple or purplish-brown on the lower lip and closely lined with purple or purplish-brown on the upper, in terminal usually dense spikes 1—4 inches long. Bracts .4-.5 inch long, elliptic, foliaceous, green, glandular-hairy, spine-tipped. Bracteoles .3 inch long, spinous. Calyx-segments unequal, up to .5 inch long, glandular-pubescent, spine-tipped. Corolla pubescent outside. Capsule .3-.4 inch long, ovoid-lanceolate, glabrous.

Occurs throughout the area up to 6,000 feet. Common on steep bare rocky or shaly slopes, on road cuttings and similar exposed positions. Flowering commences when all the larger leaves have fallen. Flowers: February—April. Fruit: April-May.

2. **Lepidagathis purpuricaulis**, Nees.—A deciduous or subdeciduous undershrub with slender erect or suberect stems 12—24 inches high and up to .15 inch diameter, persistent and becoming somewhat woody. Twigs often tinged with purple. Leaves in each pair often unequal, 2.5—5 by .7—1.1 inches, lanceolate, entire gradually tapering at both ends, more or less pubescent on both surfaces when young, glabrous or glabrescent when mature, lateral nerves arcuate 5—7 pairs. Petiole 0—2 inch long below the decurrent leaf-base. Flowers arranged in two parallel lines forming dense unilateral spikes .5—1.5 inches long, axillary and terminal, usually on dwarf lateral shoots. Spikes 3—11-flowered, solitary or clustered. Bracts solitary, .1 inch long. Bracteoles 2, linear-lanceolate, .2 inch long, 1-nerved. Calyx with 4 subequal 1-nerved segments .2 inch long and one 5-nerved segment .3 inch long. Bracteoles

and calyx glandular-pubescent. Corolla white or pale mauve with darker mauve spots on the mid-lobe of the lower lip only; tube .25 inch long; lower lip .3 inch across. Anthers glabrous. Capsule .25—.3 inch long, oblong-lanceolate, glabrous. Seeds 4.

Occurs along the Bhabar and outer hill ranges between 1,000 and 5,000 feet. Common on banks and on gravelly or rocky soils in open forest. Flowers: March-April when nearly leafless. Fruit: April-May.

3. *Lepidagathis hyalina*, Nees.—An evergreen or subdeciduous undershrub with suberect or more often prostrate stems up to 24 inches long and .2 inch diameter, scarcely woody and often rooting at the nodes. Bark smooth, pale yellowish-brown or whitish. Leaves very variable in size even on the same plant, usually 1.5—4.5 by .5—2 inches, ovate, acuminate, margin sinuate, base narrowed and decurrent on the petiole, rather densely clothed with short hairs on both surfaces; lateral nerves 6—10 pairs, arcuate. Petiole 0—.5 inch long below the decurrent leaf-base. Flowers in dense unilateral spikes, clustered several together in dense terminal heads .5—1.75 inches long. Bracts and bracteoles similar, .25—.3 inch long (those subtending the spikes slightly larger), 1-nerved, ovate-lanceolate. Calyx-segments .25 inch long, 4 subequal and 1 slightly broader, with 1 principal and 2—4 subsidiary nerves. Bracts, bracteoles and calyx-segments clothed with long silky hairs and scattered short glandular ones. Corolla white spotted on both lips with pale yellowish-brown and at the tip of the mid-lobe of the lower lip with mauve; tube .2—.25 inch long; lower lip .2—.25 inch across. Anthers slightly hairy. Capsule .2 inch long, glabrous. Seeds 4.

Occurs throughout the area up to 5,000 feet. Abundant in the Bhabar tract, usually in open forest. Flowers: March-April. Fruit: April-May.

10. *ADHATODA*, Nees.

Shrubs. Leaves opposite, entire. Flowers subsessile in the axils of opposite bracts of axillary and terminal, sometimes thyrsiform, spikes. Bracts and bracteoles large, not membranous. Calyx 5-lobed, the 2 lowest lobes subconnate. Corolla 2-lipped; tube short; upper lip helmet-shaped, subentire; lower spreading, 3-lobed. Stamens 2, near the top of the corolla-tube. Stigma entire. Ovules 2 in each cell. Fruit a clavate-oblong capsule with long solid base. Seeds 1-2, compressed.

***Adhatoda Vasica*, Nees.** Vern. *Basinga*, Gen. *Basig*, A.—An evergreen shrub 5—10 feet high with stems up to 1.5 inches diameter. Bark yellowish-brown, fairly smooth. Leaves 4—8 by 1.5—3 inches, elliptic or lanceolate, acuminate, base narrowed, minutely pubescent, especially when young; lateral nerves 8—14 pairs, arcuate. Petiole .5—1 inch long. Flowers in dense axillary pedunculate spikes 1—4

inches long. Peduncles 1—4 inches long, stout. Bracts and bracteoles 4—8 inch long, foliaceous, green, minutely pubescent. Calyx 3—5 inch long, with 5 oblong-lanceolate, glabrous or pubescent, equal lobes. Corolla 9—11 inches long, white throughout or with a branched pale purple vein on the lower lip inside, pubescent outside; the lower lip 4—6 inch across. Capsule 75—1 inch long, pubescent.

Occurs throughout the area up to 4,500 feet. Often densely gregarious and abundant in many types of forest especially in riverain forests. Common also on waste lands. The leaves have a foetid smell. Flowers: January—April.

11. PERISTROPHE, *Nees*.

Herbs or undershrubs. Leaves entire, lineolate. Flowers in clusters, the clusters often arranged in lax spreading panicles. Bracts 1—4 together, exceeding the calyces and bracteoles. Calyx 5-partite; lobes narrow. Corolla-tube slender, often twisted; limb 2-lipped, the upper lip subentire, the lower 3-lobed. Stamens 2. Ovules 2 in each cell; style filiform; stigma bifid. Fruit an ellipsoid stalked capsule. Seeds usually 4, compressed.

***Peristrophe speciosa*, *Nees*.**—An undershrub with weak erect or suberect stems 2—5 feet high the basal portions persistent and softly woody attaining 35 inch diameter. Twigs terete with a large pith, clothed with short felted grey hairs. Stems swollen above the nodes. Leaves opposite, very variable in size, the larger 4—8 by 2—4 inches, elliptic, acuminate, base cuneately narrowed into the petiole, shortly pubescent on both surfaces especially along the nerves; lateral nerves 8—10 pairs, arcuate. Petiole 1—45 inches long, pubescent. Upper leaves often much smaller and subsessile. Flowers in small bracteate clusters terminating the spreading branches of a large terminal leafy panicle. Panicle-branches clothed with spreading pale grey hairs. Bracts 4—6 inch long, linear-oblong or spathulate, hairy. Calyx 3 inch long, deeply divided into 5 setaceous lobes. Corolla magenta-pink, the upper lip with a few purple spots on a whitish ground near the mouth of the tube; tube 9—11 inches long, very slender, twisted through an angle of 180 degrees; lips nearly as long as the tube. Stamens protruding about 5 inch beyond the tube.

Occurs throughout the area between 1,000 and 4,500 feet. Common and more or less gregarious in moist shady localities. Flowers: January—March.

12. JUSTICIA, *Linn.*

Herbs or shrubs. Leaves entire, usually lineolate. Flowers sessile or subsessile, in spikes or panicles, rarely solitary or in dense cymes; bracts various; bracteoles small or absent. Calyx 4-5-partite, lobes narrow. Corolla-tube as long as or shorter than the limb; limb 2-lipped,

the upper lip 2-lobed or subentire, the lower 3-lobed. Stamens 2; filaments often dilated; anther-cells with a white basal appendage. Ovules 2 in each cell; style filiform; stigma 2-fid. Fruit an ovoid or ellipsoid capsule, sometimes with a long seedless base. Seeds 4.

Justicia pubigera, Wall.—An undershrub with weak herbaceous stems 1—4 feet high, erect or straggling, the basal portion up to about 18 inches from the ground often somewhat woody and perennial attaining 3 inch diameter. Joints swollen above the nodes. Twigs terete, clothed with pale spreading hairs. Leaves opposite, variable in size, the lower 4—6 by 1·5—3 inches, elliptic or ovate, acute or bluntly acuminate, base cuneately narrowed, puberulous on both surfaces especially along the nerves, thin, membranous, dull green above, lateral nerves 6—8 pairs; the upper leaves smaller. Petiole 3—1·5 inches long. Flowers in few-flowered, lax, axillary, pedunculate, dichotomous cymes 1—4 inches long. Peduncles 5—2·5 inches long. Bracts linear, 1—1·5 inch long. Calyx 25 inch long in flower, segments linear, glandular-hairy outside. Corolla 5—7 inch long, bright purplish-red, the lower lip with a conspicuous white branched vein; tube somewhat inflated from near the base, glandular-hairy outside. Capsule 8·9 inch long, clavate, pubescent.

Occurs throughout the central and inner ranges between 3,000 and 6,000 feet. Scarce. Usually in moist forests. Flowers: August—October.

13. DICLIPTERA, Juss.

Herbs or undershrubs. Leaves entire or sinuate, lineolate. Flowers sessile or subsessile, in clusters or panicles of cymes, often together with imperfect flowers or their bracts; flowering bracts smaller; bracteoles linear. Corolla-tube slender, limb 2-lipped, upper lip entire or emarginate, lower 3-lobed. Stamens 2. Ovules 2 in each cell; style filiform; stigma bifid. Fruit a clavate capsule with solid base. Seeds compressed, glabrous.

Dicliptera bupleuroides, Nees. Syn. *D. Roxburghiana*, Nees. var. *bupleuroides*, Clarke.—A tufted herb or undershrub 1—3 feet high with a short perennial basal portion which is sometimes softly woody. Twigs quadrangular or ribbed, with a large pith, usually pubescent on two sides. Leaves very variable in size, those in a pair often unequal, the larger usually 3·4 by 1·5—2 but occasionally up to 8 by 3·5 inches, ovate, acuminate, entire, base cuneately narrowed into the petiole, sparsely hairy on both surfaces; lateral nerves 5—7 pairs. Petiole 5—3 inches long. Flowers in dense, compound, axillary, sessile, capitate cymes and terminating short axillary branchlets 5—1·5 inches long.

Bracts up to .5 inch long, cuspidate or shortly aristate, hairy. Calyx .2-.3 inch long, segments setaceous, hairy but not glandular. Corolla .6—.8 inch long, pink the upper lip with a few purple spots on a whitish ground near the mouth of the tube; lips about as long as the tube; tube twisted through an angle of 90 degrees. Capsule .2—.25 inch long, pubescent.

Occurs throughout the area from 1,000 to 6,500 feet. Very common in open forest and as a weed near cultivation. Flowers: October—April.

LXVI.—VERBENACEÆ.

Herbs, shrubs or trees. Leaves opposite or whorled, simple or rarely digitate, exstipulate. Inflorescence various. Flowers hermaphrodite, rarely polygamous, usually irregular, often showy. Calyx inferior, gamosepalous, usually 4- or 5-lobed (rarely more), persistent and often accrescent, sometimes 2-lipped. Corolla gamopetalous, usually 2-lipped and 5-lobed, or two posterior lobes connate into one, sometimes subregular. Stamens usually 4, didynamous, rarely 2 or more than 4, inserted on the corolla-tube; filaments free. Ovary 2—4-celled, entire or 4-lobed, ovules usually 2 sometimes 1 in each cell; style usually slender, stigma entire or bifid. Fruit usually drupaceous with a single stone or 4—1 bony pyrenes, rarely capsular and 1—4-celled.

- I.—Leaves digitate 1. *Vitex*.
- II.—Leaves simple.
 - A. Flowers in dense capitate or cylindric spikes ... 2. *Lantana*.
 - B. Flowers in cymose panicles.
 - 1. Flowers regular. Stamens all equal ... 3. *Callicarpa*.
 - 2. Flowers 2-lipped or 4-5-lobed. Stamens unequal.
 - (a) Flowers 1-2 inches diameter, brown and yellow ... 4. *Gmelina*.
 - (b) Flowers .75 inch diameter or less.
 - * Calyx .5—·75 inch diameter, funnel-shaped, bright orange or scarlet ... 5. *Holmskioldia*.
 - ** Calyx small, not brightly coloured.
 - † Fruit with 1 pyrene. Flowers very small ... 6. *Premna*.
 - †† Fruit with 4 pyrenes or capsular.
 - (i) Flowers .7 inch diameter or more. Inflorescence and young shoots not clothed with purplish hairs ... 7. *Clerodendron*.
 - (ii) Flowers .2—·6 inch diameter. Inflorescence and young shoots more or less clothed with purplish hairs... 8. *Caryopteris*.

1. VITEX, *Linn*.

Trees or shrubs. Leaves opposite, digitately 3—7-foliolate, sometimes 1-foliolate. Flowers in cymes forming panicles or corymbs. Calyx campanulate or tubular-campanulate, truncate or shortly 5-lobed. Corolla small, 2-lipped, upper lip 2-lobed, lower 3-lobed the midlobe

much the longest. Stamens 4, didynamous, usually exserted. Ovary 2—4-celled; style filiform; stigma bifid. Fruit a drupe; mesocarp fleshy; endocarp a bony normally 4-celled pyrene.

Vitex Negundo, Linn. Vern. *Shiwa* or *Siwāli*, Gen.—A large deciduous shrub up to 15 feet high and 2·5 feet girth, the stems often decumbent at the base, spreading widely and sometimes rooting in contact with the ground. Bark pale somewhat reddish-brown, slightly rough, peeling off in thin papery strips. Blaze 15—25 inch, slightly fibrous, pale yellow with a few indistinct pale orange streaks. Twigs white-tomentose. Leaves digitately 3—5-foliolate. Petiole 1·2 inches long. Leaflets 2—6 by 4—1·5 inches, lanceolate, acuminate, entire crenate or coarsely serrate, nearly glabrous above, covered with fine white tomentum beneath, the terminal the largest on a petiolule 4—1 inch long, the lateral on shorter petiolules or sub-sessile. Flowers 2—3 inch diameter, lavender or white, in opposite cymes arranged in oblong terminal panicles 2—8 inches long which are often branched at the base. Calyx 1—1·5 inch long, white-tomentose. Corolla 3 inch long, tomentose or puberulous outside. Drupe 1·5 inch diameter, black.

Occurs throughout the area up to 4,500 feet. Common, especially bordering large streams, in dry river beds or in open miscellaneous forests of the Bhabar. It sometimes forms small gregarious patches. Flowers: March—August.

2. LANTANA, Linn.

Erect or subscandent, often rambling, pubescent or scabrous shrubs; branches 4-angled, sometimes prickly. Leaves simple, opposite or ternate, often rugose. Flowers in pedunculate capitate ovoid or cylindric spikes; bracts conspicuous, persistent. Calyx small, membranous, truncate or obscurely toothed. Corolla-tube slender; lobes 4 or 5, spreading. Stamens 4, didynamous, included. Ovary 2-celled; ovules 1 in each cell; style short; stigma oblique, subcapitate. Fruit a drupe with 2 bony 1-seeded pyrenes.

Flower-heads soon elongating. Bracts ovate. Branches
not rough 1. *indica*.

Flower-heads not elongating. Bracts lanceolate. Branches "
rough with very small prickles 2. *Camara*.

1. **Lantana indica**, Roxb.—An erect shrub 2—6 feet high. Branches quadrangular, densely adpressed-hairy. Leaves opposite, 1—3·5 by 4—1·75 inches, ovate, rather variable, usually very rugose with impressed nerves above and prominent veins beneath, subacute, base rounded or narrowed, crenate-serrate, finely pubescent or more or less scabrid above, more or less densely pubescent beneath or villous on the nerves only. Petiole 1—3 inch long. Flowers 2·3 inch

diameter, white or pale purple, unscented in close heads which soon become ovoid and finally cylindric and 1—1·5 inches long in fruit. Peduncles 1—3 inches long, somewhat lengthening in fruit, slender, quadrangular, hairy, axillary. Bracts ovate or obovate, acuminate, softly hairy on both sides, the lower up to ·5 inch long, the upper smaller. Calyx about ·05 inch long, truncate. Corolla-tube ·25—·35 inch long, pubescent outside; lobes 4, rounded. Fruit ·15—·2 inch diameter, purple.

There are specimens at Dehra Dun from Kaladhungi in the Ramnagar Division and from Naini Tal and it is reported to occur in the East Almora Division. It will probably be found throughout the area up to 5,000 feet, though scarce. Flowers more or less all the year round.

2. **Lantana Camara**, *Linn.*—An evergreen or deciduous shrub usually 4—8 feet high with densely entwined sarmentose branches up to 2 inches diameter which when supported climb up to 20 feet high. Bark pale brown, roughish. Blaze ·2 inch, somewhat fibrous, pale yellowish darkening on exposure. Twigs more or less prickly, pubescent, prickles when present hooked. Leaves opposite, 2—4 by 1·2·5 inches, ovate or ovate-oblong, subacute, base subcordate truncate or cuneate and slightly decurrent on the petiole, crenate-serrate, upper surface rugose with impressed nerves, very scabrid with rough hairs above, somewhat less scabrid beneath. Petiole ·2—1 inch long. Flowers ·25—·3 inch diameter, orange, yellow, red or purple, in umbelliform capitate heads which do not lengthen in fruit. Peduncles 1—3 inches long, hispid, axillary. Bracts ·25 inch long, lanceolate, hispid. Calyx nearly ·1 inch long. Corolla-tube ·3—·5 inch long, slender, pubescent outside; lobes 4, rounded. Fruit ·2 inch diameter, greenish-black.

Occurs in the subhimalayan tract and outer hill ranges up to 5,000 feet. Very common and gregarious on waste lands near cultivation in the Bhabar and is proving a troublesome pest in many parts of India. It is indigenous to America. The flowers have a strong smell resembling that of the black currant. Flowers more or less throughout the year.

3. **CALLICARPA**, *Linn.*

Trees or shrubs with the young parts stellately tomentose. Leaves opposite, rarely ternate. Flowers small, in axillary usually corymbose dense peduncled cymes. Calyx small, truncate or minutely 4-lobed. Corolla tubular-campanulate; lobes 4. Stamens 4-5, exserted. Ovary imperfectly 2-celled; style long; stigma capitate or 2-lobed. Fruit a small drupe with 1—4 bony pyrenes.

A tree. Leaves entire. Drupe purple ... 1. *arborea*.

A shrub. Leaves crenate. Drupe white ... 2. *macrophylla*.

1. **Callicarpa arborea**, *Roxb.* Vern. *Kumhār*, *Gen.*—A small evergreen tree up to 3 feet girth and 35 feet high. Bark dark brown, somewhat rough and thinly corky. Blaze ·4—·7 inch, not fibrous or

with coarse short fibre, white or yellow sometimes with a few orange-brown streaks, the whole turning orange on exposure, juice turning black on the blade of a knife. Twigs with a large pith and clothed with rough stellate pubescence. Leaves opposite, 6·5—15 by 2·75—6·5 inches, ovate lanceolate or narrowly oblong, long-or short-acuminate, margins undulate entire, base rounded or cuneate, densely stellate-tomentose on both sides when young, glabrous or nearly so and rather glossy above when mature, densely clothed with pale grey pubescence beneath, lateral nerves 8—12 pairs, the reticulate smaller nerves prominent beneath. Petiole '8—2 inches long, stout, densely stellate-tomentose. Flowers '15 inch diameter, lilac or mauve, sweet-scented, in many-flowered axillary dichotomous corymbose cymes 2·5—5 inches across. Peduncle '5—1·5 inches long, stout. Inflorescence-branches and calyx densely clothed with pale stellate tomentum. Drupe '1 inch diameter, purplish-black.

Occurs throughout the area up to 4,000 feet. Fairly common in the Bhabar and outer hill ranges. Flowers: April—June and probably October. Fruit: August and December—January.

2. *Callicarpa macrophylla*, Vahl. Vern. *Daia*, Gen.—An ever-green or subdeciduous shrub 5—10 feet high with spreading branches up to 2 inches diameter. Bark lenticellate. Blaze '25 inch, whitish rapidly turning orange-brown. Twigs, leaves beneath and inflorescence densely stellate-tomentose. Leaves opposite, 4—10 by '1—4 inches, elliptic oblong or ovate-lanceolate, acuminate, crenate, clothed above when young with stellate pubescence ultimately glabrescent, densely grey-tomentose beneath; lateral nerves 10—15 pairs, prominent beneath. Petiole '4—8 inch long, stout, densely stellate-tomentose. Flowers '1 inch diameter, pink, in axillary dichotomous cymes 1·5—3 inches across. Peduncles '3—1 inch long, stout. Corolla '1 inch long; tube cylindric. Drupe '15 inch diameter, white, succulent.

Occurs throughout the area between 1,000 and 5,000 feet. Common and found in many different types of forest including *sal*. Flowers: June—August. Fruit: December—February.

4. *GMELINA*, Linn.

Trees or shrubs, sometimes spinose. Leaves opposite. Flowers large, yellow or brownish, in small or paniced cymes; bracts usually small. Calyx campanulate, shortly 5-toothed or subentire. Corolla obliquely campanulate or funnel-shaped; limb 4-5-lobed. Stamens 4, didynamous. Ovary 4-celled; style slender; stigma shortly bifid. Fruit a succulent drupe with hard 2—4-celled endocarp.

Gmelina arborea, Roxb. Vern. *Kumhār* or *Khamāra*, Gen.—A medium-sized deciduous tree up to 8 feet girth and 60 feet high.

Bark pale ashy or grey with blackish patches, smooth, with conspicuous circular lenticels, exfoliating in thick woody plates. Blaze .5-.6 inch, not fibrous, pale orange finely mottled with darker orange. Leaves 4-10 by 3-7 inches, broadly ovate, acuminate or caudate, entire, densely tomentose on both surfaces when quite young, glabrous above and glabrescent and glaucous beneath when mature; base usually truncate with a short cuneate attenuation at the top of the petiole; lateral nerves 5-7 pairs, the lowest pair sub-basal. Petiole 2-6 inches long, glandular at the top. Flowers 1-2 inches diameter, reddish or brown and yellow, appearing with the young leaves and arranged in cymes of 1-3 flowers along the branches of hairy lateral and terminal panicles 3-4 inches long. Calyx .2 inch long, densely fulvous-hairy. Corolla 1-1.5 inches long; limb 2-lipped, the upper 2-lobed, the lower 3-lobed and twice as long as the upper. Drupe .75-1 inch long, obovoid, seated on the calyx.

Occurs throughout the area up to 3,000 feet. Fairly common in the Bhabar but not common in the hills. The herbarium specimens of this tree from our area seem to belong to var. *canescens*, Haines which is distinguished by the grey-pubescent undersurface of the leaves. In the typical form the pubescence is stellate, whilst in var. *glaucescens*, Clarke the undersurface is glabrous. Flowers: March-April. Fruit: May-June.

5. HOLMSKIOLDIA, Retz.

Straggling or climbing shrubs. Leaves opposite. Flowers in short cymes; bracts small. Calyx broadly obconic, subtruncate, membranous, coloured. Corolla-tube curved; limb oblique, 5-lobed. Stamens 4, didynamous, exserted. Ovary of 2 carpels, each 2-celled; stigma shortly bifid. Fruit an obovoid drupe, included in the accrescent calyx, 4-lobed nearly half way down, separating into 4-1 pyrenes.

Holmskioldia sanguinea, Retz.—A shrub 5-10 feet high with straggling weak often pendent branches and stems up to 2.5 inches diameter. Twigs quadrangular with a large pith. Young shoots pubescent. Bark pale brown, smooth, the papery exterior followed by a green layer. Blaze .1-.3 inch, cheesy, yellow. Leaves 2.5-5 by 1.75-3.5 inches, ovate, acuminate, base truncate or subcordate, subentire crenate or crenate-serrate, puberulous and pubescent on the nerves beneath; lateral nerves 3-5 pairs. Petiole .5-1.5 inches long. Flowers .3 inch diameter, bright red, in few-flowered axillary cymes .5-1 inch long, the cymes usually paniced at the ends of the branches. Calyx .5-.75 inch diameter, orange or scarlet, persistent and enlarged in fruit. Corolla .75-1 inch long. Drupe .2-.3 inch long, nearly dry.

Occurs throughout the subhimalayan tract and central and outer ranges between 1,000 and 4,000 feet. Fairly common in dry miscellaneous forests. Flowers: October-December.

6. PREMNA, Linn.

Trees or shrubs, sometimes climbing, rarely herbaceous. Leaves opposite or ternate, entire or toothed. Flowers small, often polygamous in usually corymbose cymose panicles. Calyx small, 2—5-toothed or subentire, sometimes lipped. Corolla-tube short, often villous within; limb 2-lipped, 4-5-lobed. Stamens 4, didynamous. Ovary of 2 completely or incompletely 2-celled carpels; stigma shortly bifid. Fruit a small drupe with a 1—4-celled stone, seated on the calyx.

I.—Flowers in spike-like panicles ... 1. *interrupta*.

II.—Flowers in corymbose panicles.

1. A tree. Petiole .4—1 inch long, not channelled above. Calyx 5-toothed and enlarged in fruit 2. *mucronata*.
2. A shrub. Petiole .8—3 inches long, distinctly channelled above. Calyx 4-toothed and not enlarged in fruit ... 3. *barbata*.

1. *Premna interrupta*, Wall.—An erect shrub or scrambling climber with stems up to 15 feet high and 2 inches diameter. Bark pale brown, somewhat corky, lenticellate. Blaze white with distant orange streaks. Leaves opposite, 5—10 by 2—4.25 inches, elliptic or obovate, abruptly somewhat caudate-acuminate, entire, base narrowed into the petiole, puberulous on the nerves above, puberulous beneath, lateral nerves 8—10 pairs. Petiole 0—3 inch long. Flowers .15 inch diameter, white or greenish-white, scented, in erect or suberect terminal and solitary spike-like densely pubescent panicles 3—7 inches long. Cymes, the upper subsessile, the lower on short peduncles up to .25 inch long. Bracts subtending the cymes up to .4 inch long, ovate, hairy, persistent. Calyx about .05 inch long, cupshaped with two rounded lobes, sparsely puberulous outside, persistent in fruit.

Occurs throughout the central and inner ranges between 5,000 and 7,000 feet but has not been recorded west of Paithani in North Garhwal. Scarce. Flowers: May-June. Fruit: July.

2. *Premna mucronata*, Roxb. Syn. *P. latifolia*, Roxb. var. *mucronata*. Vern. *Gauntia*, H.—A small deciduous tree up to 45 feet girth and 35 feet high. Vigorous shoots often armed with stout spines 1—3 inches long, and such shoots often produce leaves in threes or rarely in fours. Bark pale, often silvery-brown with dark grey or blackish parts, roughish, exfoliating in small rounded corky scales usually .5 inch across or less. Blaze .4—.6 inch, white, cheesy, not fibrous, with a thin milky soapy juice. Leaves opposite, 3.5-6.5 by 2-3.75 inches, ovate, acuminate, base cuneate, usually entire, drying black, glabrous above when mature, softly pubescent especially on the nerves beneath; lateral nerves 4—6 pairs prominent beneath. Petiole .4—1 inch long, not channelled above. Flowers .1 inch diameter, greenish, in terminal corymbose pubescent trichotomous panicles.

Calyx less than .1 inch long, pubescent, 5-toothed. Corolla .15 inch long, pubescent. Fruit .15—.25 inch diameter, globose, purplish-black, seated on the persistent enlarged calyx.

Occurs throughout the area up to 3,000 feet. Common in dry miscellaneous forests of the Bhabar. The leaves are aromatic when crushed. Flowers: April—June. Fruit: July.

3. *Premna barbata*, Wall. Vern. *Bakhara* or *Bakarcha*, G. *Agyūna*, Gen.—A deciduous shrub 6—12 feet high with stems up to 6 inches diameter. Bark pale brown, fairly smooth, exfoliating in small scurfy pieces. Blaze .1—1.5 inch, not fibrous, pale yellow slowly darkening on exposure, juice rather slimy. Leaves opposite 4.5—10 by 2—4 inches, ovate or oblong, acuminate or caudate, base truncate or cuneate, often irregularly toothed towards the apex, drying green, puberulous on both surfaces when young, ultimately glabrous or nearly so and dark rather glossy green above; lateral nerves 4—6 pairs prominent beneath. Petiole .8—3 inches long, distinctly channelled above. Flowers .15 inch diameter, white, in terminal corymbose pubescent trichotomous panicles. Calyx less than .1 inch long, pubescent, 4-lobed. Corolla .15—.2 inch long, fringed round the mouth of the tube with long hairs; lobes 4, 3 reflexed and 1 erect or spreading. Fruit .25 inch diameter, globose, succulent, first purple then black, seated on the calyx which is not enlarged in fruit.

Occurs throughout the area between 1,000 and 5,500 feet. Common in dry miscellaneous scrub forests in the hills. I have never seen spines formed on this species, nor have I seen the leaves in threes and fours. Flowers: April-May. Fruit: July.

7. CLERODENDRON, Linn.

Trees or shrubs, sometimes rambling. Leaves opposite, rarely verticillate, simple. Flowers in axillary cymes or terminal panicles; bracts often conspicuous. Calyx campanulate, truncate or 5-lobed, persistent, often accrescent and brilliantly coloured in fruit. Corolla-tube slender or filiform; limb more or less oblique with 5 spreading lobes. Stamens 4, didynamous, exserted. Ovary imperfectly 4-celled; style filiform; stigma shortly bifid. Fruit a drupe, succulent or rarely dry, 4-grooved, separating into 1—4 pyrenes or drupels.

I.—Leaves opposite (often whorled in *C. serratum*).

Stems solid. Corolla-tube less than 1 inch long.

A. Leaves narrowly oblong, glabrous at least when mature ... 1. *serratum*.

B. Leaves broadly ovate, persistently hairy.

1. Flowers in lax panicles 3—8 inches long.
Corolla single ... 2. *infortunatum*.

2. Flowers in compact panicles 1—1.5 inches long. Corolla double ... 3. *fragrans*.

II.—Leaves whorled. Stems hollow. Corolla-tube 3 inches and over ... 4. *Siphonanthus*.

1. *Clerodendron serratum*, *Spreng.*—An erect deciduous under-shrub 3—6 feet high, the stems wholly or partly dying back each year to a more or less woody perennial basal portion up to .5 inch diameter. Twigs smooth, green, more or less quadrangular, with a large pith. Leaves opposite, often ternate, 5—10 by 1.5—4 inches, oblong obovate-oblong or elliptic-oblong, acute, coarsely sharply and rather distantly serrate, rather thick, glabrous except when quite young, dark rather glossy green above, somewhat glossy beneath; lateral nerves 7—9 pairs curving near the margin and running for some distance close to it. Petiole 0—1 inch long. Flowers 1 inch diameter, on the lateral cymose branches of narrow terminal pubescent panicles 6—12 inches long. Bracts subtending the main branches foliaceous, up to 2 inches long. Upper bracts linear or lanceolate, .3—7 inch long. Calyx .2 inch long, pubescent. Corolla-tube .25—3 inch long, oblique at the mouth; lower lip pale blue or bright violet, the others white or tinged mauve. The whole inflorescence usually covered with a purplish-pink tomentum, especially the bracts and pedicels. Drupe .3—35 inch diameter, subglobose or deeply 2—4-lobed, first glossy emerald green, finally dark purple.

Occurs throughout the hills between 3,000 and 6,000 feet. Fairly common on south aspects in *chir* forests. Flowers: May—July. Fruit: November.

2. *Clerodendron infortunatum*, *Linn.* Vern. *Bhanua*. R.—An erect evergreen shrub 4—8 and occasionally up to 12 feet high with stems up to 3 inches diameter. Bark greenish-brown, smooth, often with very large raised corky lenticels. Blaze .05—2 inch, scarcely fibrous, pale yellow tinged with chlorophyll outside. Twigs hairy, somewhat quadrangular with a large pith. Leaves opposite, 4—9 by 3.5—8 inches, ovate, shortly acuminate, base rounded truncate or subcordate, dentate or sometimes entire, hairy on both surfaces, dull green above; lateral nerves 5—8 pairs prominent beneath. Petiole 1—6 inches long. Flowers .7—1.2 inches diameter, white with a red spot in the centre, sweet-scented, in large, lax, terminal, subcorymbose, pubescent panicles. Bracts .5—1 inch long, foliaceous, pink, deciduous. Calyx .4—6 inch long, 5-partite, often tinged with red. Corolla pubescent outside; tube .5—7 inch long, slender. Stamens protruding about 1 inch beyond the tube. Anthers purple. Drupe .25—3 inch diameter, subglobose, black when ripe, seated on the much-enlarged coraceous red calyx.

Occurs throughout the subhimalayan tract and outermost hill ranges up to 2,500 feet. Very common and densely gregarious in many *sal* forests. Flowers: January—April. Fruit: June.

3. *Clerodendron fragrans*, *R. Br.*—A shrub 2—8 feet high. Leaves opposite, 4—8 by 3—6 inches, ovate, acute or shortly acuminate, base truncate and usually cuneately attenuate near the top of the petiole,

sinuate or coarsely and irregularly serrate-dentate, pubescent on both surfaces especially when young, a few large glands near the top of the petiole; lateral nerves 4—5 pairs, prominent beneath. Petiole 2—6 inches long. Flowers 1 inch diameter, white tinged with pink, fragrant, in compact terminal corymbose panicles 3—4 inches across. Calyx .5—·7 inch long, cleft nearly half way down, sparsely hairy outside. Corolla double, glabrous outside; tube shorter than the calyx.

Indigenous to China but cultivated at low elevations in the hills and often run wild in the vicinity of villages. In general appearance this shrub resembles *C. infortunatum*. Flowers: August-September.

4. Clerodendron Siphonanthus, R. Br.—An erect undershrub 3—6 feet high with sparingly-branched usually annual and herbaceous stems which are fluted and hollow. Leaves in whorls of 3—5, 6—9 by 1—1·5 inches, oblong or narrowly lanceolate, shortly acuminate, base narrowed, entire or sinuate, rarely with a few coarse teeth above, glabrous, lateral nerves 6—10 pairs, oblique, strongly curved and anastomosing near the margin. Petiole 0—·2 inch long. Flowers .7 inch diameter, white or cream-coloured, in axillary few-flowered cymes arranged in a narrow terminal panicle 6—15 inches long. Bracts .1—·5 inch long, linear or linear-lanceolate. Calyx .5 inch long, cleft half way down. Corolla-tube 3·4·5 inches long, slender. Drupe of 1—4 connate drupels, each .3·4 inch long, dark blue when ripe seated on the enlarged bright red calyx. Seeds dark brown, surrounded by foetid green pulp.

Occurs in the subhimalayan tract up to 3,000 feet and has also been recorded by Mr. H. G. Champion from the Ranikhet Division. Apparently not common. Flowers: July-August. Fruit: September—November.

8. CARYOPTERIS, Bunge.

Small trees or shrubs. Leaves opposite, toothed or subentire. Flowers in small dense cymes, sometimes forming terminal panicles. Calyx 5-partite. Corolla 2-lipped; tube short, cylindric; limb spreading, the anterior lobe largest. Stamens 4, didynamous, exserted. Ovary imperfectly 4-celled; style filiform; stigma shortly bifid. Fruit a small globose capsule, separating into 4 concave valves with incurved margins, each valve with 1 seed.

Flowers .5·6 inch diameter in cymes arranged in narrow
terminal panicles 1. *Wallichiana*.

Flowers .2 inch diameter in axillary cymes, not forming
a terminal panicle 2. *grata*.

1. Caryopteris Wallichiana, Schauer. Vern. *Mauni* or *Makmāni*, Gen.—An erect evergreen or subdeciduous shrub 4—12 feet high with stems up to 1·5 inches diameter. Bark pale brown, rough, exfoliating in thin strips. Young shoots and inflorescence clothed with

short soft tomentum usually tinged purple. Leaves 1·5—4 by ·6—1·2 inches, elliptic or lanceolate, acuminate, usually crenate-serrate, base cuneate, puberulous on both surfaces; main lateral nerves 4—6 pairs. Petiole ·3—·5 inch long. Flowers ·5—·6 inch diameter, pale lavender-blue mauve or pink (the lower lobe much darker), in compact cymes arranged in narrow terminal panicles 2—12 inches long. Bracts subtending the cymes usually foliaceous and ·5—1·5 inches long. Upper bracts ·1 inch long, linear. Calyx ·15—·2 inch long, cleft more than half way down, pubescent, usually tinged purple. Corolla-tube ·25—·3 inch long. Stamens and style much exceeding the corolla and arched. Capsule ·15—·2 inch diameter, pubescent, dark blue when ripe, seated on the persistent somewhat enlarged calyx.

Occurs throughout the area between 1,000 and 5,000 feet. Very common in dry miscellaneous and scrub forests, also in blanks in *sal* forest. It is as a rule nearly leafless when flowering. Flowers: February—April. Fruit: May-June.

2. *Caryopteris grata*, Benth.—An evergreen shrub with erect or arching stems 2—4 feet high and up to ·5 inch diameter. Bark pale brown. Young shoots, inflorescence and petioles clothed with dense usually purplish or violet tomentum, often coloured on one side only. Leaves 4—7 by 1·5—2·25 inches, elliptic-or oblong-lanceolate, acuminate usually caudate, crenate-serrate or subentire, base rounded or cuneate, soft, membranous, with pale pubescence on both surfaces; lateral nerves 5—9 pairs, impressed above prominent beneath. Petiole ·5—·9 inch long. Flowers ·2 inch diameter, in compact axillary cymes ·3—·6 inch long. Bracts ·1 inch long, linear, pubescent. Calyx ·1—·15 inch long, densely pubescent, cleft nearly half way down, usually tinged purple. Corolla ·3 inch long, white tinged with pink or purple, the lower lip mottled or streaked with purplish-red inside. Fruit ·15—·2 inch diameter, globose, bright orange or red covered with white resinous specks. Seeds 4 surrounded by juicy pulp.

Occurs throughout the hills between 5,500 and 7,000 feet. Common in shady oak forests, usually on north aspects. The young leaves have a fetid smell when crushed. Flowers: March—May. Fruit: May-June.

LXVII.—LABIATÆ.

Herbs or undershrubs, rarely shrubs, usually with aromatic smell due to ethereal oils; branches usually 4-angled. Leaves opposite or sometimes whorled, simple or rarely pinnatisect, exstipulate. Flowers hermaphrodite, more or less zygomorphic, solitary or in contracted cymes in the axils of leaves or bracts forming false whorls which are sometimes crowded into heads or spikes. Calyx inferior, persistent, more or less tubular, 4-5-lobed, the lobes often forming 2 lips. Corolla tubular at base; limb 4-5-lobed or 2-lipped. Stamens inserted in the corolla-tube, 2 or 4 perfect, subequal or didynamous. Disk prominent. Ovary 4-lobed or-partite; ovules solitary in each lobe; style simple, slender, bifid (sometimes unequally). Fruit of 4 dry (rarely fleshy), indehiscent, 1-seeded nutlets.

- I.—Flowers clustered in ovoid heads ... 1. *Thymus*.
- II.—Flowers clustered in dense cylindric spikes (often in axillary clusters in *Colquhounia*).
 - A. Spikes one-sided ... 2. *Pogostemon*.
 - B. Spikes not one-sided.
 - 1. Twigs, petioles and leaves beneath more or less densely white-tomentose.
 - (a) Stamens 2—4 times the length of the corolla ... 3. *Leucosceptrum*.
 - (b) Stamens scarcely or not exceeding the corolla.
 - (i) Flowers white, .1 inch long ... 4. *Colebrookia*.
 - (ii) Flowers yellow, orange or red, .7—.9 inch long ... 5. *Colquhounia*.
 - 2. Twigs petioles and leaves beneath not densely white-tomentose.
 - (a) Calyx with strong transverse ribs in fruit ... 6. *Geniosporum*.
 - (b) Calyx not transversely ribbed ... 7. *Elscholtzia*.
- III.—Flowers in axillary cymes, whorls or racemes, not crowded into heads or spikes (except *Plectranthus ternifolius*).
 - A. Flowers solitary in the axils of leaf-like bracts... 8. *Scutellaria*.
 - B. Flowers in 6—10-flowered axillary whorls ... 9. *Roylea*.
 - C. Flowers in cymes arranged in spikes or racemes 10. *Plectranthus*.

1. THYMUS, Linn.

Aromatic undershrubs. Leaves small, entire. Flowers small, in few-flowered cymes arranged in dense or lax spikes. Calyx 2-lipped; tube with 5—15 ribs, throat villous. Corolla 2-lipped; upper lip straight, flattish, notched; lower 3-fid. Stamens 4, spreading, lower pair longer. Ovary 4-lobed. Nutlets nearly smooth with dry pericarp.

Thymus Serphyllum, *Linn.* Eng. Wild Thyme.—A deciduous undershrub with slender more or less procumbent stems which attain 12 inches long and .15 inch diameter. Twigs clothed with short white hairs. Leaves opposite, .2—4 inch long, ovate-oblong, gland-dotted on both sides, usually with a few long white cilia near the base. Petiole very short. Flowers .15 inch diameter, pale purple, dimorphous, in small whorls crowded into ovoid or nearly globose terminal spikes. Calyx .15 inch long, pubescent and gland-dotted; upper lip 3-toothed; lower 2-toothed. Corolla .3 inch long, gland-dotted; the tube as long as the calyx, cylindric. Stamens exserted.

Occurs along the slopes of the main Himalayan range between 11,000 and 14,000 feet. Usually on grassy slopes. The leaves and flowers are aromatic. Flowers: July—October.

2. POGOSTEMON, *Desf.*

Herbs or shrubs. Flowers small in subcapitate whorls or cymes arranged in solitary or densely paniced spikes or contracted racemes. Calyx subequally 4-5-toothed. Corolla-tube included or exserted; 2-lipped, the upper lip 3-lobed, lower entire. Stamens 4, exserted; filaments usually bearded. Disk subentire.

Pogostemon plectranthoides, *Desf.* Vern. *Lujra*, SG. *Rudera*, R. *Kala-basinga*, H.—An evergreen or deciduous shrub 3—8 feet high, the branches more or less succulent and herbaceous. Stems erect, up to 1.5 inches diameter. Bark pinkish-brown, smooth. Twigs subquadrangular, smooth, usually tinged with purple, often dark purplish-brown. Leaves opposite, 4—8 by 2.25—5 inches, ovate, acute or acuminate, base rounded or cuneate, doubly serrate, pubescent or glabrous, dull green, rather thick and fleshy; lateral nerves 4—7 pairs, impressed above prominent beneath. Petiole .5—5 inches long. Flowers .15 inch diameter in dense one-sided capitate spikes arranged in dense one-sided paniced axillary and terminal villous racemes. Bracts ovate, foliaceous, up to .4 inch long, usually tinged pink, pubescent, ciliate. Calyx .15 inch long, pubescent, 5-toothed. Corolla .3 inch long, white; tube slender; upper lip with 3 rounded lobes, lower lip entire. Stamens exceeding the corolla by about .25 inch, mauve, the exserted portion clothed with long mauve hairs. Nutlets minute.

Occurs throughout the area up to 5,000 feet. Very common on waste ground, especially in moist depressions. Often gregarious. When in flower the inflorescence has a strong aromatic smell. Flowers: December—March.

3. LEUCOSCEPTRUM, *Smith.*

A shrub or small tree. Leaves opposite. Flowers in whorls arranged in dense cylindric terminal spikes; bracts large, transversely

oblong, caducous. Calyx campanulate, decurved; teeth 5, rounded. Corolla with 5 rounded lobes. Stamens 4, exserted.

Leucosceptrum canum, *Smith*.—A large shrub or small tree. Twigs, petioles, under leaf-surface and inflorescence more or less densely clothed with white tomentum. Leaves 5—10 by 2—4 inches, elliptic or elliptic-lanceolate, acuminate, crenate-serrate or rarely entire, base narrowed, upper surface with scattered stellate hairs when young glabrous when mature, lower surface densely clothed with short white felted tomentum; lateral nerves 10—13 pairs. Petiole .5—1.5 inches long. Flowers .25—.3 inch long, white or pinkish; spikes 3—6 inches long and .6-.7 inch diameter without the stamens. Pedicels very short. Calyx .2 inch long, densely stellate-hairy without. Corolla slightly exceeding the calyx. Stamens .5—.75 inch long; filaments stout, yellow. Nutlets triquetrous.

Has only been collected in the East Almora Division, where it occurs between 6,000 and 8,000 feet on the slopes of the main Himalayan range. It appears to be scarce. There is a specimen at Dehra Dun from Nagling in the Darma valley. Flowers: September-October.

4. COLEBROOKIA, *Smith*.

A densely hoary shrub. Leaves opposite or rarely ternate. Flowers functionally dioecious, in bracteate clusters arranged in paniced spikes. Calyx-tube very short; teeth subulate, in fruit elongating and plumose. Corolla-lobes 4, subequal. Stamens 4, very short, equal. Disk regular. Fruit of 1—4 dry, hairy nutlets.

Colebrookia oppositifolia, *Sm.* Vern. *Binda* or *Bindu*, Gen. *Bhūri-rūderi*. R.—An erect evergreen shrub 4—12 feet high with stems up to 2 inches diameter. Twigs, petioles and inflorescence densely silky-tomentose. Twigs quadrangular. Bark pale brown, slightly rough, thinly corky. Blaze .1 inch, yellow turning pale orange on exposure. Leaves 5—11 by 1.5—4 inches, elliptic-oblong, acuminate, crenate, base acute, somewhat pubescent especially on the nerves, dull green and rugose with impressed nerves above, softly tomentose beneath; lateral nerves 12—15 pairs arcuate. Petiole .5—1.25 inches long. Flowers .1 inch long, white, in dense whorls aggregated into paniced spikes 2—4 inches long. Panicles terminal and in the axils of the upper leaves. Calyx .1 inch long in flower, 5-partite with plumose teeth which in fruit are .15—.25 inch long and filiform. Corolla a little shorter than the calyx. Nutlets minute, hairy at the tip.

Occurs throughout the area up to 4,500 feet. Very common and is found in many varying types of forest, frequent in *sal* forest. Flowers: January—March.

5. COLQUHOUNIA, Wall.

Shrubs erect or scandent. Leaves opposite. Flowers in whorls which are axillary and in spikes or racemes; bracts minute. Calyx 10-nerved, subequally 5-toothed, throat naked. Corolla 2-lipped, upper entire or notched, lower 3-lobed; tube incurved. Stamens 4, ascending, didynamous, the lower ones shorter. Style unequally 2-fid.

Colquhounia coccinea, Wall. Vern. *Pothi* or *Pharpattia*, NG.—

An erect deciduous shrub usually 4-5 feet high but attaining 12 feet with stems up to 3 inches diameter. Bark pale yellowish-brown, rough and furrowed. Twigs, petioles and undersurface of leaves clothed with thick white woolly tomentum. Leaves 3·5—7 by 2—4 inches, ovate or ovate-lanceolate, acute, dentate-crenate, base rounded or cuneate, more or less stellately pubescent above, densely white-tomentose beneath, rugose with impressed nerves and dull green above; lateral nerves 10—15 pairs. Petiole 1·5—2 inches long, terete. Flowers 1·7—1·9 inch long, varying from pale yellow to deep orange or red, clustered in the leaf-axils or arranged in dense terminal racemes up to 3 inches long. Pedicels very short. Calyx 1·25—1·4 inch long, clothed outside with short woolly hair. Corolla pubescent without; upper lip more or less entire. Nutlets flattened, winged above, about 1·2 inch long.

Occurs in the immediate vicinity of Naini Tal and also in the Dhauli valley of North Garhwal between 4,500 and 8,500 feet, but though abundant in both these widely separated localities I have no record of its occurrence on the intermediate ranges of hills. Usually found in open forest or on open waste or boulder-strewn ground near cultivation. The plants within our area appear to be always densely clothed on the under leaf-surface with white woolly tomentum and never glabrate, as is sometimes the case in other parts of its range (*vide* F. B. I.). Flowers: June—October. Fruit: September—December.

6. GENIOSPORUM, Wall.

Herbs or shrubs, erect or procumbent. Leaves opposite or whorled, floral leaves bract-like, often coloured. Flowers small, in many-flowered whorls arranged in terminal spikes or racemes. Calyx ovoid in flower, tubular and often with strong transverse ribs in fruit; lobes 5, the uppermost larger but not decurrent. Corolla 2-lipped; tube short; upper lip 4-lobed, lower entire. Stamens 4, didynamous, exserted. Disk swollen, gibbous. Fruit of 4 dry nutlets.

Geniosporum strobiliferum, Wall.—An erect herb or shrub with stems 3—6 feet high and up to 1 inch diameter. Twigs quadrangular, clothed with short reflexed hairs. Leaves opposite, 3—5·5 by 1·25—2·25 inches, ovate or lanceolate, acute or shortly acuminate, crenate-serrate, base usually unequal and cuneately attenuated on the petiole, clothed on both surfaces but especially on the nerves beneath with short stout hairs; lateral nerves 6—8 pairs. Petiole 1—1·4 inch long. Flowers 1·25

inch long, in many-flowered whorls arranged in terminal and axillary spikes 2—6 inches long, often with a pair of small whitish leaves at the base. Bracts ovate, hairy outside, up to .75 inch long. Pedicels about .05 inch long. Calyx about .1 inch long in flower, hairy outside; in fruit .3 inch long with strong transverse ribs and with two black glands on the upper lip. Corolla white with purple veins.

Occurs in the Central and East Almora Divisions between 2,000 and 4,000 feet. There are specimens from near Askot. This species is usually described as a herb but Mr. W. J. Lambert assures me that it is usually shrubby in East Almora and attains the dimensions given above. Flowers: July—September.

7. *ELSCHOLTZIA*, Willd.

Herbs or shrubs, often strongly scented. Flowers small, in whorls aggregated into simple or paniced, sometimes one-sided spikes. Calyx 5-toothed, erect and often enlarged in fruit. Corolla-tube straight or incurved; limb oblique or sub-2-lipped; upper lobe or lip notched, erect; lower spreading. Stamens 4, sometimes unequal. Disk produced behind the ovary. Style subequally bifid.

Leaves ovate. Petiole .75—2.5 inches long. Flowers

yellow ... 1. *flava*.

Leaves lanceolate. Petiole 0—2 inch long. Flowers

white ... 2. *polystachya*.

1. *Elsholtzia flava*, Benth. Vern. *Pothi*, NG.—A deciduous shrub with erect sparingly-branched stems usually 3—4 feet high but up to 8 feet high and 1.25 inches diameter. Bark pale brown, rough, exfoliating in thin fibrous strips. Twigs quadrangular, hairy, with small raised dark brown tubercles. Leaves opposite, 4—8 by 2.25—4.5 inches, ovate or rhombic-elliptic, caudate-acuminate, serrate, base cuneate rounded or subcordate, pubescent especially on the nerves above, pubescent on the nerves and closely gland-dotted beneath; lateral nerves 7—9 pairs, arcuate. Petiole .75—2.5 inches long. Flowers .25 inch long, yellow, in dense many-flowered whorls, aggregated into dense axillary and terminal pedunculate spikes 2—4 inches long, sometimes two from the same leaf-axil. Bracts ovate or lanceolate, deciduous. Pedicels up to .1 inch long. Calyx .1 inch long in flower, puberulous and glandular outside; .2 inch long in fruit, tubular. Corolla 2-lipped, puberulous outside. Nutlets ellipsoid.

Occurs throughout the hills between 5,000 and 9,500 feet. Common on the inner ranges usually in shady ravines and moist localities in oak forest, often on sites of abandoned cultivation, forming dense gregarious patches. The leaves are strongly aromatic when crushed. Flowers: September–October.

2. *Elsholtzia polystachya*, Benth.—An erect deciduous shrub usually 5—10 feet high but attaining 15 feet with stems up to 4 inches diameter. Bark pale brown, rough, exfoliating in long narrow fibrous strips. Blaze 1.2 inch, yellowish. Twigs subquadrangular, a groove

down each face, hoary when young. Leaves opposite, 3·5—7 by 1·25—3 inches, elliptic-lanceolate, acute or acuminate, base narrowed, serrate, pubescent on both surfaces, minutely gland-dotted with yellow glands beneath and sometimes also above; lateral nerves 6—12 pairs prominent beneath. Petiole 0—·2 inch long. Flowers 1·5—·2 inch long, white, aromatic, in cylindric spikes 2—8 inches long by ·3—·5 inch across when in flower; spikes solitary terminal or several in the axils of the upper leaves. Calyx ·05 inch long. Corolla tomentose outside with yellow resin dots near the mouth; limb spreading, 4-lobed. Stamens exerted. Anthers purple. Nutlets oblong.

Occurs throughout the hills between 6,000 and 10,500 feet. Very common in secondary forest growth especially on abandoned cultivation, sometimes forming gregarious patches in open *banj* forest. The leaves are very aromatic when crushed. Flowers: September-October. Fruit: November.

8. SCUTELLARIA. *Linn.*

Herbs or undershrubs. Leaves opposite; floral leaves usually small and bract-like. Flowers in axillary whorls, or whorls spiked or racemed, sometimes only 1-2-flowered. Calyx 2-lipped, the lips closed in fruit, upper lip with a broad peltate or concave scale on the back and finally deciduous when the nutlets are ripe. Corolla 2-lipped, the tube usually sharply recurved above the calyx and then ascending; upper lip entire or notched, lower broad, 3-lobed. Stamens 4, didynamous. Disk elongate. Ovary oblique; upper style-lobe short.

Scutellaria repens, *Buch. Ham.*—A subdeciduous shrub with stems 1—3 feet high and more or less erect or sometimes weak and straggling, attaining 5 feet long and ·5 inch diameter. Bark pale brown. Leaves ·3—1 inch long, ovate, acute, the lower usually coarsely crenate-serrate, the upper entire, minutely hairy especially beneath, base acute or truncate rarely subcordate. Petiole ·2—·5 inch long. Flowers ·5-·6 inch long, white tinged with pink, solitary in the axils of leaf-like bracts arranged in lax terminal glandular-hairy racemes; racemes mostly terminating short lateral branches. Bracts usually ·2-·3 inch long. Pedicels ·1—·15 inch long. Calyx scarcely ·1 inch long, glandular-hairy; upper lip deciduous in fruit bearing on its back a large hood-like shield (the posterior calyx-lobe); lower lip entire, persistent in fruit and closing the calyx-mouth. Corolla-tube slender, bent to one side near the base, glandular-pubescent outside; upper lip erect hood-like. Nutlets minute. blue.

Occurs throughout the hills between 2,000 and 5,000 feet. Common on exposed steep slopes, often on road cuttings or in crevices of precipitous rocks or walled terraces, the branches sometimes hanging in dense festoons. Flowers: February-April and again October.

9. ROYLEA, Wall.

A hoary shrub. Flowers in axillary 6—10-flowered whorls. Calyx-tube cylindric, 10-nerved; lobes 5. Corolla-tube included; limb 2-lipped; upper lip erect, hooded, entire; lower spreading, 3-fid, midlobe longest. Stamens 4, didynamous. Style-lobes subequal.

Roylea calycina, Briquet. Syn. *R. elegans*, Wall. Vern. *Karui*, G.—An evergreen shrub usually bushy with weak spreading branches when growing in the open, often subscandent with stems up to 12 feet high and 2 inches diameter when supported by surrounding vegetation. Bark pale brown, rough and somewhat softly corky. Young shoots tomentose. Leaves opposite, 1—1·5 by ·6—1 inch, ovate, acute, crenate or inciso-crenate, base broadly cuneate, adpressed-pubescent above, tomentose on the nerves and dotted with minute colourless glistening glands beneath, lateral nerves 2-3 pairs. Petiole ·1-1 inch long, slender, tomentose. Flowers ·3 inch diameter, white sometimes tinged with pink, in lax axillary 6—10-flowered whorls. Calyx pubescent and gland-dotted; tube ·25 inch long; lobes nearly as long as the tube, enlarged in fruit. Corolla ·5 inch long; tube cylindric. Nutlets ovoid-oblong, smooth.

Occurs throughout the hills between 2,000 and 5,000 feet. Fairly common in open places and miscellaneous scrub forest. The leaves are very bitter to the taste. Flowers: March-April.

10. PLECTRANTHUS, L'Herit.

Herbs or shrubs, stems usually square. Leaves opposite or ternate. Flowers in paniced or racemed 6—8-flowered cymes or whorls, with pairs of floral leaves. Calyx usually 2-lipped, enlarged in fruit; lobes 5, subequal or the uppermost widest. Corolla 2-lipped; tube exserted, straight or decurved; upper lip short, 2—4-fid, recurved; lower entire, boat-shaped. Stamens 4, didynamous. Disk usually produced in front, large. Style bifid at the tip.

I.—Undersurface of leaves hairy but not white-tomentose.

Corolla-tube abruptly bent at the base ... 1. *Cætsu*.

II.—Under-surface of leaves hoary or, white-tomentose.

Corolla-tube straight.

1. Leaves ·75—2 inches long, opposite ... 2. *rugosus*.

2. Leaves 3—6 inches long, usually ternate ... 3. *ternifolius*.

1. **Plectranthus Cætsa**, Buch.-Ham. Vern. *Molchāra*, NG.—

A deciduous or subdeciduous undershrub with erect stems 2—6 feet high herbaceous in the upper portions but often quite woody within 1-2 feet of the ground and attaining 1 inch diameter. Branches quadrangular, each face more or less grooved down the centre, with large pith, clothed with pale reflexed hairs. Leaves opposite, very variable in size, lower ones up to 6 by 3·5 inches, ovate, acuminate, dentate, base truncate or

cuneate narrowed into a short petiolar wing, hairy on both surfaces, dull green above; lateral nerves 4—6 pairs, prominent beneath. Petiole up to 1·5 inches long, flattened above. Flowers ·3—·35 inch long, pale lavender-blue with 2—4 purple spots or stripes on the upper lip, in few-flowered cymes arranged in axillary and terminal pubescent panicked racemes 3—6 inches long. Calyx ·05—·1 inch long, ribbed, decurved in fruit. Corolla-tube bent at right angles near the base; upper lip obscurely lobed. Nutlets broadly ellipsoid, smooth.

Occurs throughout the hills between 3,000 and 7,500 feet. Very common both in forest and on open waste lands, often gregarious. Flowers: September-October. Fruit: December.

2. *Plectranthus rugosus*, Wall. Vern. *Kurkha*, NG.—An erect bushy shrub 2—4 feet high with stems up to ·5 inch diameter. Bark pale brown, rough, exfoliating in long papery strips. Young shoots, inflorescence, petioles and leaves beneath more or less densely clothed with white stellate pubescence. Leaves opposite, ·75—2 by ·4—1 inch, ovate or elliptic, obtuse, crenulate, base cuneate or truncate and cuneately-attenuated below, dull green pubescent and very rugose with much impressed nerves above, densely white-tomentose beneath. Petiole ·2—·5 inch long. Flowers ·25—·4 inch long, white or pale lavender-blue spotted and streaked with purple, in few-flowered axillary cymes ·3—1 inch long arranged in terminal leafy or leafless panicles. Peduncle and pedicels slender. Calyx ·1—·15 inch long, woolly-pubescent. Corolla-tube straight; upper lip shorter than the lower. Nutlets oblong.

Occurs throughout the hills between 4,500 and 9,500 feet. Very common and gregarious on steep stony and shaly slopes in the inner dry valleys of upper Garhwal, less frequent on the central and outer ranges. The leaves are exceedingly aromatic. Flowers: July—October. Fruit: April-May.

3. *Plectranthus ternifolius*, Don.—A deciduous undershrub 2—5 feet high, the sparingly-branched erect shoots either dying back each year to a perennial woody base or the lower portions of the stem persisting and becoming somewhat woody. Twigs tomentose, striate, reddish-brown, 6-angled with large pith. Leaves opposite or ternate, usually ternate, 3—6 by ·6—1·25 inches, lanceolate, acuminate, serrate or crenate-serrate, base acute, upper surface clothed with short hairs, lower surface hoary-tomentose. Petiole 0—·1 inch long. Flowers ·2 inch long, white or pale lilac with pink spots at the base of the upper lip, in compact densely villous cymes crowded in erect, terminal, branched, spike-like panicles 6—15 inches long. Calyx ·05 inch long in flower, densely villous outside, ·15 inch long in fruit, tubular, prominently ribbed, 5-toothed. Corolla clothed outside with deciduous tomentum; tube straight. Nutlets trigonous, acuminate.

Occurs throughout the area up to 5,500 feet. Fairly common in open grassy forest, often on southern aspects in *chir* forest. Flowers: November-December.

LXVIII.—NYCTAGINACEÆ.

Herbs shrubs or trees. Leaves usually opposite, entire, exstipulate. Flowers 2 (rarely 1)-sexual, regular, sometimes dimorphous. Inflorescence various, flowers often minute in heads cymes or umbels, which are sometimes paniced. Perianth gamophyllous, petaloid with the tube persistent and accrescent; limb 3—5-lobed, plaited in bud. Petals absent. Stamens 1—30, hypogynous, sometimes unilateral; filaments usually unequal. Ovary free, 1-carpellary, 1-celled; style filiform; stigma simple or multifid; ovule solitary. Fruit a thin-walled achene, enclosed in the hardened perianth-tube.

BOERHAAVIA, Linn.

Erect or diffuse herbs or shrubs. Leaves opposite. Flowers small, arranged in panicles umbels or heads; pedicels jointed; bracts small, rarely forming a minute involucre. Perianth-tube long or short; limb funnel-shaped, 5-lobed. Stamens 1—5, exserted. Ovary oblique, stipitate; stigma peltate. Nut small, viscidly glandular.

Boerhaavia diffusa, Linn. Syn. *B. repens*, Linn. vars. *diffusa* and *procumbens*, F. B. I.—A deciduous or subdeciduous undershrub with flexible trailing stems up to 4 feet long and 5 inch diameter. Bark pale brown with large rough raised lenticels. Twigs swollen at the nodes, usually tinged pink or purple. Young shoots puberulous. Leaves in unequal pairs at the nodes, 5—15 by 4—12 inches, ovate oblong or suborbicular, acute or obtuse, rather thick and fleshy, dull green and glabrous above, whitish with minute hairs on the nerves beneath, lateral nerves 3-4 pairs. Petiole 3—15 inches long. Flowers 1—15 inch diameter, pinkish-mauve, sessile or subsessile, in few-flowered umbellate heads arranged in lax pedunculate axillary and terminal panicles often reduced to a single pedunculate head. Perianth about 1 inch long; tube glandular-hairy; limb with 5 narrow vertical bands outside. Fruit 15 inch long, obovoid, prominently 5-ribbed, glandular-hairy between the ribs.

Occurs in the subhimalayan tract and outer hill ranges up to 4,000 feet. As regards its further distribution in the hills I am uncertain. Common on waste ground. Frequently only annual herbaceous shoots are produced, but failure to persist is in such cases probably due to grazing or similar causes. The root is very long and stout. The leaves become more or less tinged with pink or purple some time before falling. Flowers chiefly during March and April and again in September and October.

LXIX.—AMARANTACEÆ.

Herbs, rarely shrubs or undershrubs, erect or climbing. Leaves opposite or alternate, exstipulate, simple, usually entire. Flowers small, usually hermaphrodite, sometimes polygamous or 1-sexual, usually in dense heads or spikes, the outer in a cluster or head sometimes imperfect and altered, heads or spikes often paniced, bracts and 2 bracteoles nearly always present and chaffy or scarious like the perianth. Perianth dry, persistent, usually of 5 free or connate segments. Stamens 1—5, opposite the perianth-segments; filaments free or connate below or united with intervening membranous staminodes into a hypogynous cup. Ovary formed of 1—3, rarely more carpels but always 1-celled; styles 0—3, rarely 4; stigmas capitate or feathery; ovules 1, rarely several. Fruit an utricle, rarely a berry capsule or nut, sometimes enclosed in the perianth.

I.—Leaves alternate or with opposite and alternate leaves mixed.

A. Glabrous or nearly so. Spikes or racemes not dense.

1. Flowers pedicellate. Racemes 2—12 inches long. Fruit more than 1-seeded ... 1. *Deeringia*.

2. Flowers subsessile. Spikes 1—2 inches long. Fruit 1-seeded ... 2. *Bosia*.

B. More or less tomentose. Spikes dense and silky ... 3. *Aerna*.

II.—Leaves opposite.

A. Flowers all perfect, in simple spikes ... 4. *Achyranthes*.

B. Flowers in clusters or heads which are arranged in spikes, each cluster containing only 1-2 perfect flowers.

1. Sterile flowers reduced to stellate hooked bristles ... 5. *Pupalia*.

2. Sterile flowers reduced to a single hooked perianth-segment ... 6. *Cyathula*.

1. DEERINGIA, R. Br.

Rambling or climbing shrubs. Leaves alternate. Flowers hermaphrodite or polygamo-dioecious, in simple or paniced spikes. Perianth-segments 5, scarcely scarious, spreading in fruit. Stamens 4—6, connate at the base. Ovary sessile or shortly stipitate; styles 2—4 connate below; ovules many. Fruit a berry. Seeds few or many.

Deeringia celosioides, R. Br. Vern. *Wali*, G.—An evergreen shrub 4—8 feet high with straggling stems up to 4 inches diameter and often drooping branches. Bark pale brown, fairly smooth. Blaze 1-2

inch, not fibrous, whitish. Branches smooth, green. Twigs striate. Leaves 2—5 by 1-2 inches, ovate or ovate-lanceolate, long-pointed, entire, glabrescent. Petiole .2—1 inch long, slender. Flowers .2 inch diameter, pale yellowish-green, in axillary and terminal simple or paniced spike-like racemes 2—12 inches long. Pedicels .05 inch long. Perianth-segments at first reflexed ultimately spreading. Stamens 5, nearly twice as long as the perianth. Berry .2 inch diameter, scarlet, seated on the spreading perianth. Seeds usually 3.

Occurs throughout the area between 1,000 and 4,000 feet. Common in secondary scrub and open miscellaneous forest. Flowers: September-October. Fruit: November—February.

2. BOSIA, Linn.

Glabrous shrubs. Leaves alternate. Flowers small, often polygamous, 2—4-bracteolate, in spikes or racemes. Perianth-segments 5, herbaceous, rounded, concave. Stamens 5, inserted on a hypogynous 10-lobed disk. Ovary ovoid; stigmas 2-3, recurved. Berry globose.

Bosia Amherstiana, Hook. f.—A rambling shrub 10—20 feet high with stems up to 4 inches diameter, the branches often drooping. Bark rough with numerous shallow cracks. Blaze .2 inch, yellowish. Branches smooth, green. Leaves 2—6 by 1—3 inches, ovate, acute, entire, base usually broadly cuneate, dull green, lateral nerves 4—6 pairs with smaller ones between. Petiole .2—7 inch long. Flowers .2 inch diameter, green, subsessile, in axillary and terminal, simple or paniced spikes .5—2 inches long. Bracts and bracteoles rounded, closely imbricate, green with white margins. Perianth-segments erect. Berry .15—25 inch diameter, globose, crimson, succulent, seated on the adpressed perianth-segments. Seed 1, black.

Has only been collected near Joshimath in North Garhwal at 6,000 feet elevation. Its distribution extends westwards through the Punjab. Flowers: May—July. Fruit: October-November.

3. AERUA, Forsk.

Herbs or undershrubs. Leaves alternate or opposite. Flowers 2-sexual or polygamous, in woolly solitary clustered or paniced spikes. Perianth-segments 4-5, membranous, all or the inner only woolly. Stamens 4-5, connate below together with alternate staminodes to form a cup. Style with capitellate or bifid stigma; ovule solitary. Fruit a membranous utricle or a circumscissile capsule with a coriaceous crown.

Aerua scandens, Wall.—A deciduous undershrub with weak erect or straggling stems 2—6 feet high and up to .75 inch diameter. Bark smooth, green or reddish. Branches grey-pubescent or tomentose.

Leaves usually alternate, 1—4 by ½—2 inches, elliptic or elliptic-lanceolate, acute at both ends, clothed on both sides with adpressed grey pubescence, entire, finely mucronate. Petiole ½—1 inch long. Flowers 1 inch diameter, green inside, bisexual, in whitish ovoid or shortly cylindric axillary and terminal spikes ½—1 inch long by ½—¾ inch diameter, usually forming a very lax terminal panicle. Bracteoles less than 1 inch long. Perianth-segments 5, lanceolate, acuminate, with long silky white hairs on the back giving the whole inflorescence a whitish appearance. Stamens 5. Fruit a membranous broadly ovate utricle. Seeds black, shining.

Occurs throughout the area up to 5,000 feet. Common in open dry miscellaneous forest and waste places. The weak stems usually seek support from the surrounding vegetation. Flowers principally during October—February.

4. ACHYRANTHES, Linn.

Herbs or undershrubs. Leaves opposite. Flowers hermaphrodite, in simple or paniced spikes; bracts and bracteoles spinescent. Perianth-segments 4-5, narrow, one or all awned, shining, coriaceous. Stamens 2—5; filaments connate at the base with intermediate quadrate staminodes which are toothed, or have a toothed dorsal scale. Style filiform; stigma capitate; ovule solitary. Fruit an utricle.

Stems perennial or only the upper shoots deciduous.

Staminodes red ... 1. *aspera*.

Stems annual and dying back to a stout persistent root-stock. Stamines white ...

... 2. *bidentata*.

1. *Achyranthes aspera*, Linn.—A deciduous or subdeciduous undershrub with weak erect stems 1—4 feet high and up to ½ inch diameter. Twigs striate, pubescent, subquadrangular. Leaves variable in size, usually 2½—4½ by 1½—2½ inches, elliptic obovate or suborbicular, apex rounded or abruptly short-acuminate, base acute, entire, more or less softly tomentose on both surfaces, dull green above; lateral nerves 7-8 pairs. Petiole ½—1 inch long, deeply channelled above. Flowers ½—¾ inch diameter, in terminal and axillary pubescent spikes 6—12 inches long, soon deflexed against the rachis which elongates considerably in fruit. Bracts ovate, awned, persistent. Bracteoles ovate, spinescent. Perianth glabrous, green; segments ovate-oblong, acuminate, becoming hardened in fruit. Stamens 5, staminodes 5, all connate at the base to form a membranous cup, the staminodes forming a fimbriate fringe along its upper edge, this fringe and the fertile stamens coloured rosy pink. Fruit an oblong utricle enclosed in the hardened perianth.

Occurs throughout the area up to 6,000 feet. Common in waste places and in dry exposed positions. Stems are perennial and the basal 1-2 feet often becomes distinctly woody in old plants. Flowers: June—October. Fruit: July—December.

2. *Achyranthes bidentata*, Blume.—A deciduous undershrub, the erect or suberect stems 1—4 feet high, dying back annually to a more or less woody rootstock or the basal portion partly persisting and attaining 12 inches long and $\frac{1}{4}$ inch diameter. Twigs striate, pubescent, more or less quadrangular. Leaves usually 4—8 by 1.75—3.5 inches, elliptic, entire, margin undulate, acuminate, base acute or obtuse, clothed with short spreading hairs on both surfaces, dull green above; lateral nerves 6—9 pairs. Petiole $\frac{1}{2}$ — $\frac{3}{4}$ inch long, channelled above. Flowers $\frac{1}{25}$ — $\frac{3}{10}$ inch diameter, in terminal and axillary spikes 2—10 inches long, soon deflexed against the pubescent rachis. Bracts ovate, awned. Bracteoles broadly auricled to nearly half-way up the spine. Perianth glabrous green; segments ovate-oblong, acuminate, becoming hardened in fruit. Stamens and staminodes as in *A. aspera*, but the fimbriate fringe to the staminodes is white or greenish, not pink. Fruit an oblong utricle enclosed in the hardened perianth.

Occurs throughout the hills between 5,500 and 8,000 feet. Common in waste places and in shady oak forest where it is often somewhat gregarious. Some authors regard this species as merely a variety of *A. aspera*. Flowers: June—October. Fruit: July—December.

5. PUPALIA, Juss.

Herbs or undershrubs. Leaves opposite. Flowers perfect and imperfect mixed together in spiked clusters, the imperfect reduced to awns with stellately spreading hooked bristles. Perianth-segments 5, herbaceous, acuminate, 3—5-nerved. Stamens 5, slightly connate below. Style slender; stigma capitellate; ovule solitary. Fruit a membranous utricle enclosed in the perianth.

Pupalia lappacea, Moq.—An undershrub or herb with weak rambling stems 2—6 feet high and up to $\frac{3}{5}$ inch diameter. Branches terete, tomentose. Leaves variable in size, 1.5—5 by $\frac{1}{4}$ —2 inches, ovate or elliptic, acute or acuminate, entire, base rounded or cuneate, membranous, tomentose on both surfaces when young, ultimately glabrescent above, lateral nerves 6—10 pairs. Petiole $\frac{1}{4}$ — $\frac{1}{2}$ inch long. Flowers $\frac{1}{25}$ inch diameter, green, in approximate or distant clusters arranged in terminal spikes 4—10 inches long; rachis slender, tomentose. Clusters containing one perfect flower and several imperfect ones, the perianth-segments of which are reduced to stellately spreading hooked bristles. Bracts and bracteoles apiculate. Perianth of perfect flowers 5-partite; segments lanceolate, awned, densely white-woolly. Seed $\frac{1}{4}$ inch long, black, shining.

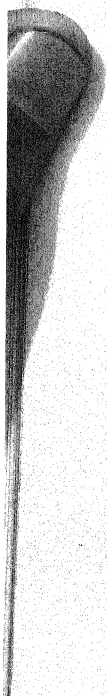
Occurs throughout the area up to 3,500 feet. Fairly common in dry scrub forest and waste places. The stems seem to die back annually to a short basal more or less woody portion. Flowers: September–October. Fruit: October–November.

6. CYATHULA, *Lour.*

Herbs or undershrubs. Leaves opposite, entire. Flowers small, in bracteate and bractolate spicate or capitate fascicles with 1-2 flowers perfect and the rest imperfect. Perianth-segments of imperfect flowers ultimately converted into rigid hooked awns. Perianth-segments of perfect flowers 5, scarious, acuminate or with hooked awns. Stamens 5; filaments connate below with intervening lacerate or 2-3-fid staminodes into a hypogynous membranous cup. Ovule solitary; style simple, filiform. Fruit an ovoid membranous utricle enclosed in the perianth.

***Cyathula tomentosa*, Moq. Vern. Lich-kura, NG.**—A deciduous undershrub usually 2—4 feet high, but occasionally up to 8 feet high with stems 1 inch diameter. Stems suberect or procumbent, ultimately woody at the base, with pale brown roughish bark. Branches succulent, smooth, green, terete, with large pith and much swollen nodes. Young shoots tomentose. Leaves variable in size, usually 3·5—7 by 1·75—3·5 inches, elliptic, acute or acuminate, base narrowed, rather densely adpressed-hairy above, silky-tomentose beneath; lateral nerves 6—9 pairs. Petiole ·25—.75 inch long. Flowers greenish with a pale sheen, in dense globose heads ·5—.75 inch across arranged in axillary or terminal pedunculate spikes 2—6 inches long, the basal portion often interrupted, the axillary spikes sometimes reduced to a single pedunculate head. Bracts ovate, ·1—.15 inch long, cuspidate, with a line of hairs down the back. Perfect flowers 1-2 in each cluster surrounded by imperfect ones reduced to a single hooked perianth-segment. Perianth-segments of perfect flowers linear-lanceolate, about ·2 inch long, 2 or all ending in hooked awns, enlarged in fruit.

Occurs throughout the hills between 3,500 and 7,500 feet. Common on waste ground. Sometimes the whole stem, sometimes only the lower portion persists from one year to the next. Flowers: July-August. Fruit: November-December.



LXX.—CHENOPODIACEÆ.

Herbs or shrubs, often fleshy. Leaves usually alternate, simple, exstipulate. Flowers small, 1-2-sexual, often dimorphic. Bracts 1 or none. Perianth persistent, often accrescent, of 3—5 free or connate segments. Stamens usually 5, opposite the perianth-segments, hypogynous or perigynous, free or connate at the base. Ovary 1-celled: stigma capitate or 2-3-lobed; or stigmas 2—5, free or slightly united; ovule solitary. Fruit usually an utricle, rarely capsular, often enclosed in the enlarged sometimes fleshy perianth.

EUROTIA, *Adans.*

Herbs or undershrubs, woolly or tomentose. Leaves alternate, entire. Flowers minute, unisexual. Male flowers spicate, ebracteate. Perianth-segments 4, obovate, obtuse. Stamens 4, filaments filiform. Female flowers axillary, 2-bracteate; bracts conduplicate, connate with free tips, at length closing over the utricle, becoming coriaceous, veined, villous, 2-beaked and at length splitting into 4 valves. Perianth 0. Stigmas 2, filiform. Fruit an ellipsoid compressed utricle.

Eurotia ceratoides, *C. A. Mey.* Vern. *Gēb-singh*, Bhotia.—An erect rather stiff bushy deciduous shrub about 1 foot high with stems up to .35 inch diameter. Bark pale ashy or yellowish-brown, slightly rough. Young shoots and leaves hoary with stellate tomentum. Leaves .5—1.5 by .2—5 inch, oblong, elliptic or ovate-lanceolate, obtuse, pale glaucous and clothed on both surfaces with woolly tomentum when young. Petiole up to .1 inch long. Male flowers; perianth 4-partite, hairy. Utricle .1 inch long, enclosed in a hard 2-horned capsule composed of the bracts and hidden by long silky grey hairs.

Occurs on the dry inner ranges bordering Tibet between 11,000 and 14,000 feet. It grows gregariously on open stony slopes and is locally very common. The leaves are not aromatic. Flowers: July—September.

LXXI.—POLYGONACEÆ.

Herbs or shrubs. Leaves usually alternate, simple, entire or serrulate, rarely lobed; stipules scarious or membranous, usually sheathing the stem (ochreate). Flowers usually hermaphrodite, regular, jointed on the pedicel, usually clustered with the clusters often spicate or paniced. Perianth inferior, of 3—6 free or connate persistent segments. Stamens 5—8, rarely more or fewer, opposite the perianth-segments. Disk annular, glandular or none. Ovary free, 1-celled, 2-3-gonous; styles 1—3, free or connate; stigmas various; ovule solitary. Fruit a nut, usually enclosed in the perianth which may be accrescent.

Perianth 4-5-cleft	...	...	...	1. <i>Polygonum</i> .
Perianth 6-cleft	...	...	...	2. <i>Rumex</i> .

1. POLYGONUM, Linn.

Herbs or shrubs, rarely climbing. Leaves alternate, entire, rarely lobed; stipules tubular, membranous. Flowers small hermaphrodite, clustered, the clusters sessile or in spiciform racemes. Bracts and bracteoles membranous, orchreate. Perianth 4-5- rarely 3-cleft, the two outer segments usually smallest. Stamens usually 5—8, perigynous. Ovary compressed or 3-gonous; styles 2-3, free or slightly connate; stigmas usually capitellate. Fruit a compressed or trigonous nut, covered or partially so by the more or less accrescent perianth.

I.—Flowers axillary, solitary or fascicled.

- | | | |
|--|-----|-----------------------|
| 1. Stipules with 2 distinct excurrent nerves | ... | 1. <i>recumbens</i> . |
| 2. Stipules without excurrent nerves | ... | 2. <i>plebejum</i> . |

II.—Flowers in spiciform terminal racemes.

- | | | |
|--|-----|---------------------------|
| 1. Leaves elliptic, less than 1 inch long | ... | 3. <i>vaccinifolium</i> . |
| 2. Leaves linear-lanceolate, more than 1 inch long | 4. | <i>emodi</i> . |

III.—Flowers in small more or less globose heads.

- | | | |
|--|-----|-----------------------|
| 1. Stems erect or suberect. Leaves 3—6 inches long | ... | 5. <i>chinense</i> . |
| 2. Stems creeping. Leaves 1-2 inches long | ... | 6. <i>capitatum</i> . |

IV. Flowers in large terminal panicles

- | | |
|-----|-------------------------|
| ... | 7. <i>paniculatum</i> . |
|-----|-------------------------|

1. *Polygonum recumbens*, Royle.—An undershrub with creeping herbaceous or woody stems 6 inches to 3 feet long and occasionally up to 5 inch diameter. Bark reddish-brown. Young shoots puberulous or scaberulous. Leaves 5—15 by 25—7 inch, elliptic, obtuse or acute, entire, base acute, rather thick and fleshy, glabrous except for minute glandular hairs on the margins and along the nerves beneath. Petiole up to 1 inch long. Stipules 15—25 inch long, ovate-lanceolate, with

a strong excurrent nerve on each side. Flowers $\cdot 1$ inch diameter, greenish, in axillary clusters. Pedicels $\cdot 05$ inch long. Perianth 5-partite; segments spreading in flower. Nut $\cdot 05$ inch long, trigonous, black, shining.

Occurs throughout the hills between 4,000 and 8,500 feet. Very common on newly exposed surfaces, roadsides and waste places. Usually herbaceous but occasionally quite woody and persistent. Flowers: June—August.

2. *Polygonum plebejum*, R. Br.—An undershrub with slender prostrate herbaceous or woody stems 6—24 inches long. Twigs terete, striate, glabrous. Leaves variable in size, usually $\cdot 2$ — $\cdot 5$ inch long, linear oblong or narrowly obovate, sessile or shortly stalked. Stipules colourless, rather short, lacerate to the middle and fimbriate, nerves usually obscure. Flowers about $\cdot 1$ inch long, pink, axillary, solitary or 2-3 together, sessile or nearly so. Perianth 4- or 5-partite. Nut trigonous, shining.

Probably occurs throughout the subhimalayan tract and central and outer hill ranges up to 6,000 feet. This is a very variable species and is separable into perhaps as many as eight distinct varieties. I am unable to state with any certainty which varieties occur within our area. Flowers: March—May.

3. *Polygonum vacciniifolium*, Wall.—A deciduous shrub with slender creeping stems up to $\cdot 4$ inch diameter. Bark rough, fibrous, pale brown. Leaves $\cdot 4$ — $\cdot 8$ by $\cdot 25$ — $\cdot 5$ inch, elliptic, usually acute at both ends, entire, glabrous. Petiole $\cdot 05$ — $\cdot 15$ inch long. Stipules $\cdot 3$ — $\cdot 5$ inch long, membranous with strong longitudinal excurrent nerves which persist after the intervening membrane has disappeared. Flowers $\cdot 25$ inch diameter, pink, in subsessile spiciform racemes 1-2 inches long terminating short side shoots. Perianth $\cdot 15$ inch long, 5-partite. Pedicels slender, up to $\cdot 1$ inch long. Bracts $\cdot 1$ — $\cdot 15$ inch long, ovate, acuminate, membranous.

Occurs along the main Himalayan range between 10,000 and 13,000 feet. It is common and is sometimes found in forests of *Betula utilis*, at others growing in the open above forest level, but nearly always amongst boulders to which it clings closely by means of adventitious roots, often forming a dense matted growth. The leaves turn reddish before falling. Flowers: August—October.

4. *Polygonum emodi*, Meissn.—A glabrous undershrub with slender creeping stems up to $\cdot 25$ inch diameter, and short ascending leafy branches. Bark rough, reddish-brown. Leaves $1\cdot 25$ — 3 by $\cdot 15$ — $\cdot 3$ inch, linear-lanceolate, gradually tapering to a point at both ends, entire, with very numerous parallel oblique secondary nerves, rather coriaceous. Petiole 0 — $\cdot 15$ inch long. Stipules $\cdot 7$ — 1 inch long, oblong-lanceolate, long-acuminate, membranous, with numerous parallel nerves. Flowers nearly $\cdot 2$ inch long, red or pink, in erect long-peduncled

terminal spike-like racemes .5—1.5 inches long, usually solitary sometimes two together. Bracts .1—.15 inch long, ovate, acute, membranous. Pedicels slender .1-.2 inch long. Perianth 5-partite. Stamens 8. Nut trigonous, smooth, shining.

Occurs along the main Himalayan range between 8,000 and 13,000 feet. It is usually found amongst rocks or boulders, the stems creeping over the ground and rooting at intervals. The leaves turn reddish before falling. Flowers: July—October.

5. *Polygonum chinense*, Linn. Vern. *Amēta*, NG.—An undershrub with erect procumbent or arching stems usually 2—4 feet high but up to 8 feet long and .35 inch diameter, persistent and somewhat softly woody with a large pith. Twigs smooth, terete, glabrous, a membranous stipular sheath .7—1.2 inches long enveloping the basal portion of each internode. Leaves 3—6 by 1.25—2 inches, oblong-lanceolate, acuminate, margin entire with fine undulations, base rounded or truncate with a narrow extension on the petiole, glabrous on both surfaces except the midrib beneath which is conspicuously clothed with white hairs. Petiole .3—.8 inch long, flattened above. Flowers .15—.2 inch diameter, white often tinged pink, in few-flowered heads .3-.4 inch across arranged in lax terminal and axillary, pedunculate, corymbose panicles. Perianth 5-partite; segments persistent and fleshy in fruit. Stamens 8. Anthers blue. Nut .1 inch long, trigonous, black, enclosed within the juicy perianth to form an ovoid or globose fruit .25—.35 inch long which is first white then shining black.

Occurs throughout the hills between 5,500 and 8,000 feet. Fairly common in shady forest and moist ravines, often among boulders. The arching stems frequently root at the nodes, and are occasionally subscandent. The plant described is var. *corymbosa*, Meissn. Flowers: June—October. Fruit: October–November.

6. *Polygonum capitatum*, Buch.-Ham.—An evergreen undershrub with slender herbaceous or woody creeping stems 6—12 inches long and up to .35 inch diameter. Bark reddish-brown. Young shoots hairy. Leaves 1-2 by .6—1.25 inches, ovate or ovate-elliptic, acute, entire, base rounded or cuneate, sparsely hairy on both surfaces especially on the nerves and margin, ultimately glabrescent above, often with a darker coloured horse shoe mark across the middle. Petiole 0—.1 inch long with two rounded, hairy, ear-shaped expansions at the base, one larger than the other. Stipules .2—.4 inch long, tubular, membranous, hairy. Flowers less than .1 inch diameter, pink or mauve, in dense pedunculate capitate heads .25—.5 inch diameter, solitary or 2-3 together. Peduncles hairy and glandular. Bracts ovate, acute, glabrous. Perianth 5-partite. Stamens 8. Nut trigonous, black, surrounded by the persistent perianth.

Occurs throughout the hills between 2,000 and 7,000 feet. Common on rocks and steep banks, the creeping stems rooting adventitiously. Young leaves often purplish beneath. Leaves often turn brick-red before falling. Flowers: May—July.

7. *Polygonum paniculatum*, Bl. Vern. *Amēta*, NG.—An under-shrub with arching, erect or suberect, smooth, hollow, usually tufted stems 4—8 feet high and up to 1 inch diameter often quite woody towards the base. Whole plant glabrous except the leaf-margins which are usually but not invariably ciliate. Leaves 4—8 by 2—4 inches, elliptic-ovate or lanceolate, acuminate or caudate-acuminate, entire, base rounded or acute, lateral nerves 12—24 pairs with smaller ones between. Petiole .3—1.2 inches long. Stipules 1.5—4 inches long, narrowly lanceolate, ochreate, membranous. Flowers .15—.2 inch diameter, white, in lax terminal and axillary often leafy panicles 4—12 inches long. Pedicels .05—.15 inch long, slender. Bracts minute. Perianth 5-partite; segments oblong, spreading in flower, persistent and fleshy in fruit. Stamens 8 with conspicuous interposed yellow glands. Nut less than .1 inch long, trigonous, black, enclosed within the fleshy perianth and forming an ovoid fruit .15 inch long which is first red then black.

Apparently occurs throughout the hills between 5,000 and 7,500 feet, but seems to be rather local. It is usually found in shady *banj* forest on north aspects and most frequently along the banks of streams. Flowers: September-October. Fruit: October-November.

Another species *P. frondosum*, Meissn. is recorded from Kumaon between 7,500 and 9,000 feet by Strachey and Winterbottom and is described in the F. B. I. as shrubby. According to the F. B. I. this species differs from *P. paniculatum* in the following points:—Leaf margins not ciliate. Leaf base rounded or cordate. Panicles both axillary and terminal (only terminal in *P. paniculatum*). Rather longer petioles—up to 1.5 inches. I have however found leaves both with and without ciliate hairs on the same plant, and I have found plants having axillary panicles combined with ciliate leaves so that I am disposed to regard *P. frondosum* as not specifically different from *P. paniculatum*.

2. RUMEX, Linn.

Herbs, rarely shrubs. Radical leaves usually large; stipules tubular, often disappearing with age. Flowers hermaphrodite or monoecious, in paniced or racemed whorls, rarely axillary clusters. Perianth-segments 6 in 2 series; inner accrescent, entire or toothed and often with a tubercle on the midrib in fruit. Stamens 6. Ovary trigonous; styles 3; stigmas fimbriate. Fruit a trigonous nut included in the enlarged inner perianth-segments.

Rumex hastatus, D. Don. Vern. *Almora*, Gen.—A bushy shrub usually 1—3 feet high but occasionally up to 6 feet with stems up to 1.5 inches diameter. Bark dark reddish-brown, slightly rough. Twigs herbaceous, striate. Leaves .5—2 inches long, very variable, hastate with the central lobe linear-oblong or sometimes deltoid, rather thick and fleshy, glaucous, nerveless. Petiole up to 2 inches long, flattened. Stipules .1 inch long, membranous. Flowers small, pink or green tinged with pink, polygamous, in small clusters on the racemose

branches of a large terminal panicle. Pedicels .05—.1 inch long, very slender. The three outer perianth-segments .05 inch long, oblong; the three inner rounded. Nut enclosed by the much enlarged inner perianth-segments which are membranous with retuse apex and deeply cordate base, usually tinged pink.

Occurs throughout the area between 2,000 and 7,000 feet. Common on waste ground, on shaly slopes and in dry stream-beds where it often grows gregariously. Frequent on walled terraces between cultivation. The leaves are acid. It is often completely deciduous during the rains but is very variable in this respect. Flowers: May—October.



LXXII.—ARISTOLOCHIACEÆ.

Herbs or shrubs, often climbing. Leaves alternate, simple, entire or lobed, exstipulate. Flowers hermaphrodite, solitary racemose or cymose, with or without bracts. Perianth corolline superior, regular or irregular, variously shaped, gamophyllous with valvate lobes. Stamens 6 or more, subsessile in a ring round the base of the style with which they are often combined. Ovary 4—6—rarely 5-celled, placentæ parietal; stigma lobed; ovules many. Fruit capsular or coriaceous and bursting irregularly. Seeds many.

ARISTOLOCHIA, *Linn.*

Leaves with the petioles dilated at the base, often with a stipule-like bract in their axils. Perianth-tube inflated at the base, contracted in the middle and terminating in a dilated oblique 1—2-lipped limb. Stamens 6, rarely 5 or more than 6, adnate above the ovary to form a very short column, 3—6-lobed above. Fruit a capsule, septicidally 6-valved or splitting through the placentæ, thin-walled.

Leaves lanceolate. Perianth-limb about 2 inches diameter. Capsule 3-4 inches long ... 1. *dilatata*.

Leaves ovate. Perianth-limb 7-8 inch diameter. Capsule 1-25—2 inches long ... 2. *punjabensis*.

1. *Aristolochia dilatata*, N. E. Brown.—A deciduous or subdeciduous dextrorse climber with stems 2—10 feet high and up to 6 inch diameter. Bark pale brown, fairly smooth. Twigs green, terete. Young shoots and leaves beneath clothed with silky white or brown tomentum. Leaves 4—11 by 1-75—5 inches, broadly lanceolate gradually tapering to an acute apex, entire, base deeply cordate, scabrid above, softly pubescent beneath, base 3-nerved the laterals again branching close to the base with about 4—7 pairs above the basal, dull green above pale beneath, with conspicuously raised secondary and tertiary nerves. Petiole 1—3 inches long, terete. Flowers solitary, axillary, emitting a strong unpleasant orduriferous smell. Peduncle about 5 inch long. Ovary 5—8 inch long, prominently 6-ribbed. Perianth dark purplish-red inside the expanded limb, paler and mottled with white inside the inflated tube, pale purplish and pubescent outside, glabrous inside except the basal about 5 inch of the tube; tube inflated in the lower half then suddenly recurved and narrowed, 1-5—1-6 inches long from the base to the outside edge of the curve; limb suborbicular, obscurely 3-lobed, about 2 inches diameter. Anthers 6, sessile, adnate

in pairs round the base of the broad column. Stigma 3-lobed. Capsule 3-4 by .7-.8 inch, oblong, longitudinally ribbed, pubescent especially along the ribs.

Occurs throughout the hills between 7,000 and 8,500 feet. Fairly common in shady forests of *Quercus dilatata*. Flies are attracted by the unpleasant smell of the flowers which appear with the young leaves or when leafless during April-May.

2. *Aristolochia punjabensis*, *Lace.*—A deciduous twining shrub up to 15 feet high, but more frequently an undershrub with procumbent stems 1—3 feet high. Twigs densely clothed with spreading or retrorse pubescence, ultimately becoming glabrous. Leaves variable in size, 3—9 by 2—7 inches, broadly ovate, entire, apex usually acute, base deeply cordate with rounded lobes, scabrid above, softly pubescent beneath especially on the nerves, base 3-nerved the laterals again branching close to the base with about 3—6 pairs above the basal. Petiole .5—2 inches long, densely hairy. Flowers solitary, axillary; peduncles about .8 inch long, densely hairy. Perianth dull greenish-brown, densely pubescent outside glabrous inside except the base; tube inflated in the lower half, then suddenly recurved, .7—·9 inch long from the base to the outside edge of the curve; limb suborbicular, obscurely 3-lobed, .7-.8 inch diameter. Anthers 6, sessile. Stigma large, 3-lobed. Capsule 1.25—2 by .6 inch, hexagonal, pubescent especially on the angles or ridges, dehiscent from the apex.

Has recently been collected by Mr. R. N. Parker in the Almora District at Dindihat where it was found growing between 6,500 and 7,500 feet elevation. *Lace* describes the limb as purple-veined and Parker says it is spotted inside with very small dark brown spots. Flowers: April-May. Fruit: August-September.

LXXIII.—PIPERACEÆ.

Herbs or shrubs, often climbing, usually with minute aromatic glands commonly appearing as transparent dots on the leaves. Leaves alternate, opposite or whorled, entire; stipules 0 or connate and intrapetiolar or adnate to the petiole. Flowers minute, 1—2-sexual, in axillary or terminal spikes and subtended by peltate bracts. Perianth none. Stamens 2—6, rarely 1 or 7-8, hypogynous. Ovary of 3 or 4 carpels free or connate below, each with many ovules, or ovary 1-celled with a solitary ovule; stigmas distinct on the free carpels or ovary-lobes, or terminal on the undivided ovary, occasionally solitary, sessile. Fruit of cocci or follicles, or baccate and indehiscent.

PIPER, *Linn.*

Shrubs rarely herbs, often climbing, with swollen nodes, usually glandular and aromatic. Leaves entire, often oblique, stipulate. Flowers very minute, diœcious rarely hermaphrodite, spiked, each in the axil of a peltate bract or bract adnate to and sometimes decurrent on the rachis, lateral bracteoles sometimes present and forming low ridges on each side of the flower or connate in a semilunar form. Stamens 1—4, rarely more; filaments short. Ovary 1-celled; style conic, beaked or none; stigmas 2—6; ovule solitary. Fruit baccate.

Male spikes 3 inch long 1. *brachystachyum*.

Male spikes 2-3 inches long 2. *peepuloides*.

Besides the above species *P. nepalense*, Miq. is recorded from Garhwal by Edgeworth, but we have no specimens from this area at Dehra Dun. There are however two sheets at Kew labelled *P. nepalense*, one of which was collected by Edgeworth from "Nathpoor, Himalaya." The other is from Royle's collection and the only locality given is N. W. India. These records do not enable me to state definitely that either sheet was collected within our area. In *P. nepalense* the spikes, both male and female are from 2 to 7 inches long and the bracts are orbicular and sessile but not peltate. The leaves are glabrous and much resemble those of the species described.

1. Piper brachystachyum, Wail.—An evergreen glabrous shrub with tough flexible stems up to 1 inch diameter either creeping over the ground or climbing up the stems of trees by means of adventitious shoots, the creeping stems producing reproductive shoots 1-2 feet long with large one-sided swollen joints. Bark brown, rough owing to numerous much-raised lenticels. Twigs smooth, green. Leaves alternate, those on flowering stems 3—5.5 by 1.5—2.5 inches, ovate or elliptic, caudate-acuminate, base narrowed, lateral nerves running longitudinally, the upper pair starting from above the base and reaching the apex, the middle pair starting from close above the base, the lowest pair

basal. Petiole .4—·8 inch long, channelled. Stipules membranous enclosing the buds. Leaves of sterile climbing shoots 1—3 by .9—2 inches, orbicular with rounded cordate base. Petiole .6—1.3 inches long. Flowers dioecious, in solitary leaf-opposed spikes at the ends of the shoots. Male spikes ovoid .3 inch long; peduncles .2 inch long. Female spikes .2-.3 inch long, ovoid, green. Peduncles .1-.2 inch long. Fruit of many berries crowded into a globose dark green head .3—.35 inch diameter.

Occurs throughout the hills between 2,000 and 5,000 feet. Fairly common in shady moist ravines, especially on rocks. The climbing stems occasionally attain 20 feet high. Flowers: May-June. Fruit: December..

2. *Piper peepuloides*, Roxb.—A glabrous bushy shrub, climbing below with free spreading slender branches which are often rough with raised lenticels. Leaves alternate, 2—5 by 1-2 inches, oblong or ovate-oblong, caudate-acuminate, base rounded or slightly cordate, lateral nerves running longitudinally, the upper pair starting from above the base and reaching the apex, the middle pair starting from close above the base, the lowest pair basal. Petiole .15—.5 inch long. Flowers dioecious, in solitary leaf-opposed spikes. Male spikes slender 2-3 inches long, clothed with peltate bracts. Stamens 2—4. Female spikes .5—.7 inch long, cylindric, longer than their peduncles.

There is one sheet at Dehra Dun collected by Inayat at Dogadni in the Mandal Range of the old Garhwal (now Kalagarh) Division, which I have taken as belonging to this species. Flowers: May-June.

LXXIV.—LAURACEÆ.

Trees or shrubs, or (*Cassytha*) a parasitic climber. Leaves usually alternate, entire, often with a characteristic aromatic smell when bruised, exstipulate. Flowers small, greenish or yellowish, regular, 1-2-sexual, often clustered or cymose, mostly 3-merous. Perianth usually inferior; the segments usually in 2 series of 3 each, subsimilar, often connate below, more rarely 5 or rudimentary or wanting. Stamens in 2—4 trimerous whorls of which one whorl is often reduced to staminodes, hypogynous or perigynous, inner often with 2 large glands at the base. Ovary 1-celled; style terminal; stigma simple, discoid or dilated, often 3-lobed; ovules solitary. Fruit a dry or fleshy berry, rarely enclosed in or adnate to the perianth-tube, but often surrounded at the base by the thickened accrescent receptacle or by the base of the tube.

I.—Flowers in panicles.

A. Fruit supported by the base of the perianth only 1. *Cinnamomum*.

B. Fruit supported by the entire perianth.

- | | |
|--|----------------------|
| 1. Perianth-lobes linear or oblong, spreading or reflexed in fruit | 2. <i>Machilus</i> . |
| 2. Perianth-lobes elliptic or ovate, clasping the base of the fruit | 3. <i>Phœbe</i> . |

II.—Flowers in umbellate heads which are solitary clustered or arranged in lax corymbs.

- | | |
|----------------------------|---------------------|
| 1. Anthers 4-celled | 4. <i>Litsea</i> . |
| 2. Anthers 2-celled | 5. <i>Lindera</i> . |

III.—Flowers axillary, solitary or 2 together ... 6. *Dodecadenia*.1. CINNAMOMUM, *Blume*.

Evergreen trees or shrubs. Leaves opposite or alternate, usually with 3 basal nerves. Flowers in axillary and terminal panicles, often polygamous with females larger. Perianth-tube short; segments 6, subequal. Stamens 9, or sometimes fewer, in 3 whorls, the fourth whorl of 3 staminodes; anthers 4-celled. Fruit seated on the enlarged perianth-tube, or hypanthium.

Leaves strongly 3-nerved from close above the base ... 1. *Tamala*.

Leaves penninerved 2. *glanduliferum*.

1. **Cinnamomum Tamala**, *Nees*. Vern. *Dalchini*, *Gen*.—A small evergreen tree up to 4·5 feet girth and 25 feet high. Bark dark brown or blackish, slightly rough. Blaze 5 inch, pinkish or reddish-brown with whitish streaks towards the exterior. Leaves opposite sub-opposite or alternate, 5—8 by 2·3 inches, ovate-lanceolate or-oblong,

acuminate, the acumen often falcate, coriaceous, glabrous, scarcely shining above, glaucous beneath, 3-nerved from close above the base almost to the apex. Petiole 3—5 inch long. Flowers 3 inch long, pale yellowish, in axillary and terminal lax puberulous panicles 2—6 inches long. Perianth-lobes 6, oblong, silky-pubescent, breaking off transversely below the middle after flowering. Perfect stamens 9. Filaments villous. Drupe 5 inch long, ovoid, fleshy, black, supported by the somewhat enlarged perianth-tube bearing the truncated perianth-lobes.

Occurs throughout the hills between 2,000 and 7,000 feet. Fairly common in shady forest especially bordering streams. Quite young leaves are coloured pink. The bark is used as a substitute for cinnamon which is the bark of an allied species *C. zeylanicum*, Breyne. Flowers: May. Fruit: June-July.

2. *Cinnamomum glanduliferum*, Meisn.—A small tree up to 5 feet girth. Leaves 3—5 inches long, alternate, elliptic or lanceolate, caudate-acuminate, puberulous beneath when young, glabrous when mature, thickly coriaceous, often glaucous beneath; lateral nerves 3-4 pairs. Petiole 5—1 inch long, slender. Flowers 1 inch diameter, yellowish-green, in lax long-peduncled few-flowered glabrous axillary panicles 1.5—2.5 inches long. Perianth-lobes sparsely pubescent without, villous within. Stamens hairy. Ovary glabrous.

Occurs in the most easterly portions of Almora between 4,000 and 7,000 feet. Mr. W. J. Lambert informs me that it is not uncommon in oak forests. We have only one sheet at Dehra Dun collected at Chirapani at 6,000 feet elevation. Flowers: May-June.

2. MACHILUS, Nees.

Evergreen trees. Leaves alternate, penninerved. Flowers bisexual, in axillary panicles often appearing sub-terminal at first. Perianth of 6 free or nearly free persistent lobes, spreading or reflexed in fruit. Stamens 9 perfect, anthers 4-celled, those of the third series extrorse and 2-glandular; staminodes of the fourth series cordate. Stigma discoid. Fruit a globose or ellipsoid berry seated on the persistent perianth.

I. Panicles glabrous. Fruit oblong or ellipsoid ... 1. *odoratissima*.

II.—Panicles pubescent. Fruit globose.

A. Leaves quite glabrous when mature.

1. Petiole not exceeding 1 inch. Filaments villous at the base only.

(a) Leaves 5—10 inches long. Lateral nerves 12—20 pairs ... 2. *Duthiei*.

(b) Leaves 3—6.5 inches long. Lateral nerves 5—12 pairs ... 3. *Gamblei*.

2. Petiole 5—1.5 inches long. Filaments hairy throughout ... 4. *sericea*.

B. Mature leaves more or less silky beneath ... 5. *bombycina*.

1. **Machilus odoratissima**, Nees. Vern. *Kaula*, G. *Kāb*. A.—A medium-sized evergreen tree commonly attaining 6 feet girth and 50 feet high. Bark dark grey or blackish, somewhat rough. Blaze .75—1.5 inches, soft with scattered pieces of hard tissue, pinkish-brown with a few narrow white or yellow bands towards the exterior which turn orange on exposure. Twigs glabrous. Leaves 3—7 by 1.25 inches, oblong oblanceolate or elliptic-oblong, acute or acuminate, base narrowed or rounded, glabrous, dark rather glossy green above, pale and glaucescent beneath, lateral nerves 6—14 pairs. Petiole .4—1 inch long. Flowers .3—35 inch diameter, yellowish-green, scented, in glabrous panicles 1.5—5 inches long, at first terminal but the shoot soon growing through the panicle leaving its branches below the leaves. Perianth .3 inch long, lobes linear, glabrous or nearly so without, villous within. Filaments villous near the base. Fruit .6—9 inch long, oblong or ellipsoid, purplish-black with a glaucous bloom containing a large elongated seed surrounded by pale yellow fleshy tissue and supported by the swollen often pinkish pedicels.

Occurs throughout the hills between 2,500 and 7,000 feet. Very common bordering streams in *banj* forest. The new young leaves are usually tinged pink. I have measured a large tree in North Garhwal 10.5 feet girth and 35 feet high. Flowers: March-April. Fruit: June-July.

2. **Machilus Duthiei**, King. Vern. *Kaula*, G. *Sail* or *Sair*, NG.—A small or medium-sized evergreen tree seldom exceeding 4 feet girth and 40 feet high, rarely attaining 6 feet girth. Bark pale grey or whitish, slightly rough, often conspicuously lenticellate and sometimes thinly corky. Blaze pale pinkish-brown or buff often with a few pale broad streaks towards the exterior. Twigs glabrous. Leaves 5—10 by 1.25 inches, oblong or oblong-lanceolate, acute or acuminate, usually gradually narrowed at the base, dark rather glossy green above, pale and glaucescent beneath, glabrous, lateral nerves 12—20 pairs. Petiole .5—9 inch long. Flowers .2-3 inch long, yellowish-green, scented, in pubescent panicles 2.5—5 inches long appearing at the base of the young shoots below the leaves. Perianth-lobes minutely silky-pubescent on both sides. Filaments slightly villous at the base. Fruit .4 inch diameter, globose, first bright glossy green finally purplish-black containing one round seed surrounded by yellowish fleshy tissue seated on the persistent green calyx and supported by the peduncle and pedicels which are usually red.

Occurs throughout the hills between 5,000 and 9,000 feet. Very common in dense oak forests, often more or less gregarious especially beneath *Quercus dilatata*. Flowers: March-April. Fruit: June-August.

3. **Machilus Gamblei**, King. Vern. *Kaula*, G.—A medium-sized evergreen tree up to 6 feet girth and 70 feet high. Bark pale

brown, fairly smooth and often thinly corky with scattered lenticels. Blaze .3—.75 inch, soft, very short fibre, yellowish or pinkish with scattered hard orange-coloured pieces, the whole darkening on exposure, sometimes with whitish bands towards the exterior. Young twigs minutely pubescent. Leaves 3—6.5 by .7—2.25 inches, oblong oblanceolate or elliptic-oblong, acuminate, gradually narrowed to the base, dark glossy green above, pale and glaucous beneath, glabrous, lateral nerves 5—12 pairs. Petiole .4—1 inch long. Flowers .3—.35 inch diameter, yellowish-green, sweet-scented, in pubescent panicles 1.5—4 inches long appearing at the bases of the young shoots. Perianth .25 inch long, lobes minutely silky-pubescent on both sides. Filaments slightly villous at the base. Fruit .3.4 inch diameter, globose, black.

Occurs in the subhimalayan tract and in the central and outer hill ranges between 1,500 and 5,000 feet. Fairly common in moist depressions or bordering streams. Flowers: March-April. Fruit: June-July.

4. *Machilus sericea*, Blume.—A medium-sized evergreen tree up to 6 feet girth. Leaves 4—8 inches long, oblong or elliptic-oblong, acute or acuminate, base acute or rounded, coriaceous, dull green above, not glaucous beneath, conspicuously reticulate when dry, silky pubescent on both surfaces when young; lateral nerves 7—12 pairs, arched. Petiole .5—1.5 inches long. Flowers about .3 inch diameter, shortly pedicelled, in pubescent panicles 4—8 inches long. Filaments hairy. Fruit globose.

Occurs on the central and outer ranges between 3,000 and 5,000 feet elevation east of Naini Tal. Usually found in open forest and appears to be scarce. Flowers: May.

5. *Machilus bombycina*, King, *ms.*—A tree. Twigs pubescent. Leaves 4—7 by 1.25—1.75 inches, oblong-lanceolate or oblanceolate, acute or acuminate, base narrowed, glabrous above when mature, pubescent or tomentose beneath especially along the midrib, lateral nerves 6—10 pairs. Petiole .3—.75 inch long. Flowers about .3 inch diameter, in few-flowered panicles 1—3 inches long clustered at the base of the new shoots and appearing with the immature leaves. Perianth about .15 inch long, oblong, silky puberulous without, glabrescent within. Filaments glabrous except for a few hairs near the base. Fruit .3 inch diameter, globose.

This species has been collected by Messrs. W. J. Lambert and R. N. Parker (*vide* his No. 2050 at Dehra Dun) in East Almora where it occurs at 3,500 feet elevation in the neighbourhood of Askot. The material of this tree at my disposal was rather incomplete, but I have compared it with specimens at Kew and it agrees well. It appears to differ from *M. villosa*, Hook, in having larger less hairy flowers arranged in panicles which are generally shorter than the mature leaves whereas in *M. villosa* the panicles usually exceed the leaves. The panicles in *M. villosa* are also usually more numerous and bear more numerous flowers.

3. PHŒBE, *Nees*.

Evergreen shrubs or trees. Leaves alternate, penninerved. Flowers bisexual or polygamous, in axillary or subterminal panicles. Perianth-tube short; lobes 6, subequal, erect, accrescent and clasping the base of the fruit. Stamens 9 perfect, anthers 4-celled, those of the third series extrorse and 2-glandular; staminodes of the fourth series cordate or sagittate. Stigma discoid. Fruit an ellipsoid berry clasped at the base by the hardened perianth.

Mature leaves glabrous. Panicles clustered. Perianth			
glabrous without	...	...	1. <i>lanceolata</i> .
Mature leaves puberulous beneath. Panicles not clustered.			
Perianth pubescent without	...	...	2. <i>pallida</i> .

1. *Phœbe lanceolata*, *Nees*. Vern. *Kekra*, *G. Kaula*, Gen.—

A small or medium-sized evergreen tree up to 6 feet girth and 40 feet high, sometimes only a large shrub. Bark usually partly pale ashy and partly blackish, slightly rough, exfoliating in irregular thin scales of somewhat corky consistency. Blaze .3—.8 inch, soft, shortly fibrous, pale pinkish-brown. Twigs smooth, green, terete. Young shoots slightly pubescent. Leaves 4—10 by 1.2-75 inches, oblong-lanceolate, caudate-acuminate, base narrowed, sparsely pubescent above and silky puberulous beneath when quite young, glabrous when mature; lateral nerves 7—11 pairs prominent beneath. Petiole .3—1 inch long. Flowers .1 inch long, yellowish-green, in lax glabrous pedunculate panicles 3—8 inches long clustered closely round the base of the new shoots. Perianth cup-shaped; lobes elliptic, glabrous without, pubescent within, enlarged and hardened in fruit. Filaments slightly villous at the base. Fruit .3-.4 inch long, ellipsoid, truncated, black, seated on the enlarged perianth.

Occurs throughout the area between 1,000 and 4,500 feet. Very common in shady ravines and moist places. Flowers: February—June. Fruit: September—November.

2. *Phœbe pallida*, *Nees*.—A small or medium-sized evergreen tree up to 5 feet girth and 45 feet high. Bark reddish-brown, slightly rough. Blaze .25—.5 inch, pale yellowish-or pinkish-brown with a few pale yellow streaks or bands darkening on exposure. Twigs smooth, green. Young shoots adpressed-pubescent. Leaves 4—10 by 1.2.5 inches, oblanceolate or oblong-lanceolate, acuminate, base narrowed, minutely adpressed-pubescent on both surfaces when young, glabrous above when mature, margin more or less revolute, glossy dark green above with paler venation, deeply glaucous beneath with prominent secondary venation; lateral nerves 6—9 pairs. Petiole .2—.6 inch long, channelled above. Flowers .2 inch diameter, greenish-yellow, in lax puberulous pedunculate panicles 1—4 inches long arranged along the sides of the new shoots (not clustered together). Perianth .1 inch long; lobes ovate,

pubescent on both sides, enlarged and hardened in fruit. Fruit 4-5 inch long, oblong or ellipsoid, shining, bluish-or purplish-black, seated on the enlarged perianth.

Occurs throughout the hills between 5,000 and 7,000 feet. Rather scarce but well distributed. Usually in *banj* forest, especially in moist ravines. Flowers: June. Fruit: October—December.

4. LITSEA, Lamk.

Trees or shrubs, usually evergreen. Leaves alternate, rarely opposite or subopposite. Flowers dioecious, several in an umbel surrounded by an involucrel whorl of 4—6 concave sepal-like bracts; umbels pedicelled, usually again umbelled or racemed or fascicled, axillary or from leaf-or bract-scars. Perianth-lobes usually 6, but sometimes very incomplete or absent, tube or hypanthium sometimes greatly enlarged in fruit. Stamens in male flowers 6—20, filaments of the one or two innermost whorls (if present) 2-glandular; anthers all introrse and 4-celled. Stigma usually irregularly lobed.

I.—Leaves penninerved. Stamens 9 or more.

A. Leaves grey-tomentose beneath. Fruit globose 1. *chinensis*.

B. Leaves brown-pubescent or glabrous beneath.
Fruit ovoid.

1. Leaves elliptic, rounded at both ends ... 2. *polyantha*.

2. Leaves narrowly lanceolate, tapering at both ends ... 3. *elongata*.

II.—Leaves more or less 3-nerved from above the base.
Stamens 6.

1. Leaves 5—13 inches long ... 4. *lanuginosa*.

2. Leaves 3—5 inches long ... 5. *umbrosa*.

1. *Litsea chinensis*, Lamk. Syn. *L. sebifera*, Pers. Vern. *Singrau*, Gen.—A small evergreen tree up to 2 feet girth and 25 feet high, often only a shrub. Bark pale brown, roughish, somewhat corky, lenticellate. Blaze 3—5 inch, cheesy, not fibrous, pale yellowish streaked and mottled with orange, the whole turning dirty brown on exposure, juice viscous. Twigs green, terete, grey-pubescent. Leaves 4—10 by 2—4 inches, elliptic ovate or oblong-lanceolate, acute or acuminate, base usually narrowed, pubescent especially on the nerves above, more or less grey-tomentose beneath, dull or slightly glossy dark green above, pale but not glaucous beneath; lateral nerves 8—13 pairs. Petiole 5—15 inches long, grey-tomentose. Flowers yellowish, about 2 inch diameter, about 8—12 together in umbellate heads 5-6 inch across arranged in lax pedunculate axillary corymbs 15—3 inches long. Peduncles of heads 2-5 inch long. Heads globose in bud, about 2 inch diameter, resembling flower-buds, surrounded by 4 orbicular tomentose bracts. Perianth-lobes generally wanting. Stamens up to 20

or more. Filaments clothed with long soft hairs. Fruit .3 inch diameter, globose, black, supported by the thickened pedicel.

Occurs throughout the subhimalayan tract and central and outer hill ranges up to 3,500 feet. Fairly common in moist miscellaneous forest, also with *sal*. The leaf when rubbed between the fingers produces a soapiness and is faintly aromatic. Flowers: June—August. Fruit: November–December.

2. *Litsea polyantha*, Juss. Vern. *Katmāra*, Gen.—A small or medium-sized evergreen tree usually not exceeding 4 feet girth and 40 feet high. Bark usually pale brown, roughish, somewhat corky, exfoliating in quite small polygonal scales. Blaze .75–1.5 inches, soft, not fibrous, pale yellowish or yellowish-brown lightly mottled with pale orange towards the exterior and darkening on exposure. Young shoots rusty-pubescent. Leaves alternate, 3–9 by 1.5–5 inches, elliptic or elliptic-oblong, usually rounded at both ends, glabrous and dark rather glossy green above when mature, glaucous with distinct reticulate venation and pale yellowish-brown pubescence beneath. Petiole .4–1 inch long, brown-pubescent. Flowers about .2 inch diameter, pale greenish-yellow, sessile or subsessile, about 5–6 together in rounded umbellate heads .4–.5 inch across. Peduncles of the heads .2–.5 inch long, solitary or clustered on dwarf side shoots. Pedicels up to .1 inch long, elongated in fruit. Heads globose in bud, about .2 inch diameter, resembling flower-buds, surrounded by 5 rounded pubescent bracts. Perianth .1 inch long. Stamens 9–13. Filaments hairy. Fruit .4 inch long, ovoid, black, supported by the enlarged perianth and enlarged thickened pedicels.

Occurs throughout the area up to 5,000 feet. Very common in *sal* forests of the Bhabar preferring moist shady localities. It occasionally attains 7 feet girth and 70 feet high. Leaves turn bright yellow as they fall. Flowers: March–April. Fruit: June—September.

3. *Litsea elongata*, Wall.—A small evergreen tree up to 4 feet girth and 30 feet high. Bark reddish-brown or sometimes covered in part with a thin whitish mealy layer, smooth or roughish exfoliating in thin woody scales. Blaze .25 inch, pale yellowish or pinkish-brown. Young shoots rusty-pubescent. Leaves alternate, 4–7 by 1–1.75 inches, narrowly oblong-lanceolate, acuminate, base narrowed, sparsely clothed on both surfaces with long spreading whitish hairs when young, quite glabrous or with rusty hairs on the midrib above and sparsely hairy on the nerves beneath when mature, glossy dark green above, dark bluish-green with prominent pale venation beneath, lateral nerves 6–13 pairs. Petiole .3–.8 inch long, terete, tomentose. Flowers small, yellowish, in heads of about 4–5 flowers. Heads solitary, rarely clustered, males .5–.7 inch diameter, females smaller. Peduncles of the heads scarcely exceeding .1 inch long. Heads about .15 inch

diameter in bud, resembling flower-buds, surrounded by 5 rounded silky-hairy bracts. Perianth .15 inch long. Stamens 8—12. Filaments villous with long hairs. Fruit .5 inch long, ovoid, seated on the enlarged perianth.

Occurs in the central and inner hill ranges between 4,500 and 7,500 feet. Rare, usually in dense *banj* forests. In the absence of flowers or fruit this species is apt to be mistaken for *Phoebe pallida* from which it may best be distinguished by the terete, not channelled, petiole. Flowers: August—September.

4. *Litsea lanuginosa*, Nees Vern. *Lampattia*, NG.—A small or medium-sized evergreen tree up to 7 feet girth and 50 feet high. Bark dark brown, slightly rough, lenticellate, exfoliating in irregular thick scales. Blaze .3—.5 inch, crisp, pale yellow or yellowish-brown streaked and mottled with orange-brown and turning dark brown on exposure. Young shoots and leaves densely clothed with adpressed silky hairs. Leaves clustered at the ends of the branches, 5—13 by 1.5—2.75 inches, oblong-ob lanceolate or narrowly elliptic-oblong, acuminate, base narrowed, glabrous when mature, shining above, glaucous beneath, strongly 3-nerved from close above the base with 2—5 smaller pairs above. Petiole .3—1 inch long. Flowers small, yellowish, in 4-flowered heads arranged in dense lateral sessile or subsessile clusters. Pedicels up to .2 inch long, silky. Perianth 4-lobed, villous without. Stamens 6. Fruit .5-.6 inch long, ovoid, on short thick pedicels.

Occurs throughout the hills between 2,000 and 6,000 feet. Distribution somewhat local and generally scarce, but fairly common and even with a gregarious tendency round Ukhimat in North Garhwal. Flowers: March. Fruit: November.

5. *Litsea umbrosa*, Nees. Vern. *Bailāra* or *Muira*, NG. *Chēr* or *Chirara*, Gen.—A small or medium-sized evergreen tree up to 4.5 feet girth and 30 feet high. Bark pale brown, slightly rough with prominent circular lenticels. Blaze .3-.4 inch, rather crisp, pale olive- or greenish-brown more or less streaked and mottled with pale yellow, rapidly darkening on exposure. Young shoots and leaves pubescent. Leaves alternate, 3—5 by .75—1.5 inches, oblong-elliptic, acuminate, base narrowed, glabrous when mature, pale and glaucous beneath, more or less (though sometimes very obscurely) 3-nerved from above the base with 3—7 smaller pairs above. Petiole .5—.8 inch long. Flowers .1 inch diameter, pale yellow, scented, in 6—12-flowered heads, arranged in dense sessile lateral clusters. Pedicels about .1 inch long, silky, much elongated in fruit. Perianth 4-lobed, villous without. Stamens 6. Fruit .4-.5 inch long, ovoid, first purplish and finally black, on pedicels .5—.7 inch long.

Occurs throughout the hills between 4,500 and 8,000 feet. Very common both in oak forests and in secondary growth, usually on north aspects, sometimes forming gregarious patches in open moist situations. Flowers: March. Fruit: October-November.

5. *LINDERA*, Thunb.

Trees or shrubs. Leaves alternate or subopposite, penni- or 3—5-nerved. Flowers dioecious, pedicellate, in sessile or nearly sessile lateral umbelliform clusters surrounded by deciduous bracts. Perianth-tube very short, segments 4—9 usually 6. Stamens 6—9 usually 9; in three series, those of the third and sometimes second also 2-glandular; anthers 2-celled, all introrse. Staminodes in female flowers 6—9, filiform. Berry seated on the unaltered or disciform, entire or toothed, base of the perianth.

Leaves penninerved 1. *bifaria*.

Leaves strongly 3-nerved from the base or near it ... 2. *pulcherrima*.

1. *Lindera bifaria*, Benth.—A large evergreen shrub or small tree up to 2 feet girth and 25 feet high. Twigs brown-tomentose or villous. Leaves variable in size, 2—6 by 1-2 inches, elliptic or ovate-lanceolate, acute or acuminate, base acute or cuneate rarely obtuse, coriaceous densely clothed with long fulvous woolly pubescence when young, glabrous or hairy only on the midrib above, more or less hairy beneath when mature, lateral nerves 5—10 pairs. Petiole .2-.3 inch long, stout, tomentose. Flowers small, in 6—10-flowered, solitary or clustered, axillary umbels which are sessile and enclosed in bud by 6—8 imbricating rounded more or less pubescent bracts. Pedicels .05—.15 inch long, villous. Perianth-tube villous; segments 6, glabrous or sparsely hairy without. Stamens 9. Filaments glabrous. Berry .25 inch diameter, globose, seated on the small cup-shaped perianth-tube.

Occurs in the East Almora Division between 3,000 and 5,000 feet. Rare, but has been found at Rawalkhet in the Ramganga valley, Helpia in Talla Askot and in the Pungar Gadh. There is a single specimen from our area at Dehra Dun collected by Mr. W. J. Lambert. It is found in shady ravines. Flowers: May.

2. *Lindera pulcherrima*, Benth. Vern. *Chêri* or *Chêr*, NG.—An evergreen shrub 5—10 feet high with stems up to 3 inches diameter. Bark dark brown, roughish. Blaze .2 inch, pale brown. Young shoots pubescent or tomentose. Leaves alternate, 4—6.5 by 1.25—2.5 inches, oblong or elliptic-oblong, abruptly caudate-acuminate, base rounded or cuneate, silky pubescent when young becoming glabrous when mature, very glaucous beneath, strongly 3-nerved from the base or close above the base, the 3 nerves subparallel. Petiole .3—.7 inch long, tomentose. Flowers .2—.25 inch diameter, yellowish-green, in 5-6-flowered, solitary or clustered, axillary umbels which are sessile and enclosed in bud by 4—6 imbricating rounded pubescent bracts. Pedicels .05—.15 inch long,

densely silky-pubescent, lengthing to .2—·5 inch in fruit. Perianth-segments 6, oblong, sparsely pubescent without. Stamens 9. Filaments nearly glabrous. Berry .3—·35 inch long, ellipsoid.

Occurs throughout the hills between 6,000 and 9,000 feet. Very common in the central and inner ranges where it often forms gregarious undergrowth in shady forests of *Quercus incana* and *Q. dilatata*. Flowers: March–April. Fruit: July.

6. DODECADENIA, *Nees*.

Evergreen trees. Leaves penninerved. Flowers dioecious solitary or 2 together, subsessile or pedicelled, each pedicel bearing several imbricating bracts. Perianth-tube short; segments 6—9, subequal, spreading. Perfect stamens 10—12 in four series, those of the two inner series bearing 2 stalked glands near the base, the others eglandular; anthers 4-celled, introrse. Ovary pubescent. Berry seated on the dilated flattened base of the perianth and thickened peduncle.

This genus is described on page 63 Vol. II of Wallich's *Plantæ Asiaticæ Rariōides* as hermaphrodite, and this seems to have been copied by subsequent authors. There seems little doubt that the description of the genus taken I presume from *D. grandiflora* was based on male flowers only as these possess a distinct pistillode giving the flowers the appearance of being hermaphrodite.

Dodecadenia grandiflora, *Nees*.—A small evergreen tree up to 4 feet girth and 30 feet high. Bark roughish, lenticellate, exfoliating in irregular woody scales. Blaze .25—·35 inch, pinkish-or orange-brown. Young shoots brown-tomentose. Leaves 3—5·5 by .75—1·5 inches, oblong-ob lanceolate or elliptic-lanceolate, acute or shortly acuminate, base narrowed, coriaceous, margin undulate, silky-tomentose when young, glabrous when mature except the midrib above which is persistently hairy, rather glossy dark green above, glaucescent beneath; lateral nerves 8—12 pairs. Petiole .3—·9 inch long, tomentose. Flowers pale yellow or greenish-yellow, axillary, usually solitary sometimes 2 together on stout tomentose pedicels up to .1 inch long. Pedicels bearing imbricating ovate bracts silky-hairy down the centre outside, about 5 in males 10 in females. Male flowers .6 inch diameter, females .3 inch. Perianth-segments 6 rarely more, in two series, oblong, obtuse, densely silky-pubescent without, less so within. Stamens in male flowers 10—12, staminodes in females 7—9. Filaments villous. Anthers with a line of hairs down the back, as long as the filaments. Berry .5—·6 inch long, ellipsoid, purplish-black.

Occurs throughout the hills between 7,000 and 8,500 feet. Rather scarce, usually in shady oak forest. Flowers: March–April. Fruit: November.

LXXV.—THYMELÆACEÆ.

Shrubs or small trees, rarely herbs with tough bast-fibres. Leaves alternate or opposite, simple, entire, exstipulate. Flowers usually bisexual and regular, in axillary or terminal heads, umbels or racemes. Perianth tubular or campanulate, usually corolline, frequently with a ring of scales or hairs at the mouth; lobes 4-5. Stamens inserted on the perianth-tube, usually twice as many as its lobes in two whorls; anthers 2-celled. Disk variously formed or none. Ovary superior, usually 1-celled; ovule solitary; style short or long; stigma various. Fruit usually a small berry, drupe or nut.

Leaves thick, glabrous or nearly so, alternate. Disk 0 or inconspicuous ... 1. *Daphne*.
Leaves thin, silky, often opposite. Disk of 4 erect scales 2. *Wikstrœmia*.

1. DAPHNE, *Linn.*

• Shrubs or small trees. Leaves (in Indian species) alternate, usually coriaceous. Flowers in terminal or lateral heads or clusters. Perianth-tube usually corolline, cylindric or somewhat widened at the base; lobes 4, spreading. Stamens 8, biseriate; anthers subsessile. Disk obscure or none. Ovary 1-celled; style short or none; stigma large, capitate. Fruit a succulent or nearly dry drupe.

I.—Leaves not exceeding 2 inches long, sessile.

1. Leaves mucronate. Perianth villous ... 1. *oleoides*.

2. Leaves obtuse, notched. Perianth glabrous ... 2. *retusa*.

II.—Leaves 2—5 inches long. Petiole very short ... 3. *papyracea*.

1. *Daphne oleoides*, *Schreb.*—A low spreading bushy shrub with stems 1—4 feet high and up to 1 inch diameter. Bark reddish-brown or blackish, fairly smooth. Young shoots clothed with short dense pubescence. Leaves 1-2 by 2—4 inch, oblong or linear, narrowed at both ends, mucronate, thick, ciliate and sparsely hairy on the midrib when young, glabrous when mature, dark bluish-green on both surfaces, lateral nerves obscure, sessile. Flowers 3-4 inch diameter, white, in terminal ebracteate 3—9-flowered heads. Pedicels minute. Perianth grey-villous outside; tube 2—35 inch long; lobes oblong, acute or sub-acute, shorter than the tube. Ovary densely hairy. Fruit 25—35 inch long, oblong, fleshy, pale orange, clothed with short silky hair, enclosed till nearly ripe within the persistent perianth-tube which ultimately dehisces. Seed 1.

Occurs along the Dhauli valley in North Garhwal between 8,500 and 9,500 feet. Rather scarce. It is found on exposed stony and rocky places. Flowers: May-June. Fruit: July-August.

2. *Daphne retusa*, Hemsl.—An erect shrub. Twigs rather stout, clothed when young with adpressed hairs. Leaves 1·5—2 by ·5—·7 inch, oblanceolate, narrowed towards the base, apex rounded and minutely notched, thick, glabrous, sessile. Flowers ·6—·8 inch diameter, in terminal bracteate clusters of about 5—7; bracts oblong-spathulate, caducous. Pedicels 0. Perianth glabrous; tube ·3·4 inch long; lobes as long as the tube, oblique, broadly oblong, obtusé, emarginate. Ovary glabrous.

This species has been collected in the Almora district by Mr. J. Lyall, vide sheet No. 8338 in the Dehra Dun herbarium. The exact locality is not recorded but the plant will probably be found along the main Himalayan range between 10,000 and 12,000 feet. Flowers: June-July.

3. *Daphne papyracea*, Decne. Syn. *D. cannabina*, Wall. in F. B. I. Vern. *Satpura*, G. Barwa, A.—An evergreen shrub 2—5 feet high with stems up to 1 inch diameter. Young shoots tomentose soon becoming glabrous. Leaves 2—5 by ·7—1·3 inches narrowly elliptic-lanceolate or oblanceolate, narrowed at both ends, thick, glabrous. Petiole up to ·2 inch long. Flowers white, in terminal bracteate heads. Bracts ·3—·7 inch long, oblong or lanceolate, caducous. Pedicels minute. Perianth-tube ·3·4 inch long, silky; lobes ·2 inch long, ovate, acute, with a tuft of hairs at the tip. Ovary glabrous. Fruit ovoid, ·4 inch long.

Occurs throughout the hills between 5,500 and 9,000 feet. Common, especially in association with *banj*. Flowers: January—April. Fruit: May-June. According to Smith and Cave in the Records of the Botanical Survey of India, volume VI, pp. 45—54, there are three closely allied Himalayan species of *Daphne*, and after reading the note referred to above I think it probable that we have two of them within our area. I have on many occasions noted that the fruit is sometimes yellow or orange-yellow when ripe and sometimes first deep-red and finally black. Smith and Cave remark as follows: "*D. papyracea*, Decne, and *D. Sureil*, Smith and Cave are at once distinguished from *D. cannabina*, Wall. by the pointed lobes of the corolla and fruits reddish at maturity. *D. Sureil* differs from *D. papyracea* in the leaves being less coriaceous and more pointed, in the bracts being very early deciduous forming no collar round the inflorescence and in the longer and narrower flowers".

2. WIKSTRÆMIA, Endl.

Trees or shrubs. Leaves opposite, rarely alternate. Flowers hermaphrodite, in terminal racemes or spikes, ebracteate. Perianth-tube elongate; lobes 4, spreading. Stamens 8, biseriate; filaments short. Disk of 1—4 scales. Ovary villous, 1-celled; style short; stigma capitate. Fruit fleshy and naked or dry and included in the base of the perianth.

Wikstrœmia canescens, Meissn.—An erect deciduous shrub 4—8 feet high with stems up to 1·5 inches diameter. Bark smooth, brown. Blaze ·25 inch, pale yellow with very tough fibre. Young shoots hairy. Leaves opposite or alternate, 1·5—3 by ·6—1 inch, elliptic-oblong, thin, silky when young becoming glabrous except along the midrib

beneath. Petiole 1 inch long, hairy. Flowers yellow, in axillary and terminal heads or short spikes often forming small panicles. Bracts 0. Perianth-tube 3 inch long, slender, silky outside; lobes 15 inch long. Disk of 4 erect linear scales. Fruit 2 inch long, ovoid, pale brown, enclosed by the persistent perianth which ultimately splits down one side. Seed 1, black.

Occurs throughout the hills between 6,000 and 10,000 feet. Fairly common especially on the inner ranges and is found either in forest or in the open, sometimes with a tendency to gregariousness. Flowers: April—June. Fruit: October–November.



LXXVI.—ELÆAGNACEÆ.

Shrubs or trees closely covered with silvery or brown scales, sometimes with stellate hairs. Leaves alternate or opposite, entire, exstipulate. Flowers regular, bisexual or dioecious, in axillary fascicles or cymes. Perianth tubular, narrowed above the ovary, persistent and sometimes thickened in fruit below; limb 2—6-lobed, rarely truncate; in male flowers reduced to a lobed limb only. Stamens adnate to the perianth-tube and twice as many as the lobes, or in the bisexual flowers as many as the lobes and opposite to them, perigynous. Ovary free in the lower part of the tube but closely invested, 1-celled; style filiform; stigma lateral; ovule solitary. Fruit a nut enclosed in the perianth-tube.

Leaves linear-or oblong-lanceolate. Flowers bisexual ... 1. *Elæagnus*.

Leaves elliptic. Flowers unisexual ... 2. *Hippophæ*.

1. ELÆAGNUS, Linn.

Flowers bisexual, solitary or in small clusters. Perianth with an oblong or globose persistent base, narrowed above the ovary into a campanulate or funnel-shaped deciduous limb, valvately 4-lobed. Stamens 4, on the mouth. Style linear, included. Fruit a nut enclosed in the accrescent usually berry-like perianth-base.

Stem erect. Leaves stellately hairy above when young.

Flowers 4 inch diameter ... 1. *umbellata*.

Stem rambling or climbing. Leaves scaly above when

young. Flowers 2 inch diameter ... 2. *latifolia*.

1. *Elæagnus umbellata*, Thunb. Vern. *Geowain*, G. *Giwai*,

A.—A subdeciduous shrub or less frequently a small tree up to 5 feet girth and 20 feet high with rounded crown, usually more or less armed with stout thorns. Bark dark brown, rough, exfoliating in irregular scales. Blaze 25—75 inch, pinkish, fibrous with an open cellular structure. Young shoots clothed with silvery scales. Leaves alternate, variable in size, 1.25—5 by .6—1.5 inches, elliptic or elliptic-oblong, acute acuminate or obtuse, base rounded or narrowed, margin undulate, densely clothed above with white stellate hairs when young, soon becoming glabrous, persistently clothed with silvery scales beneath. Petiole 2—4 inch long, clothed with silvery scales. Flowers 4 inch diameter, white or creamy, fragrant, axillary, solitary or in dense few-flowered clusters appearing with the young leaves. Pedicels 1—1.5 inch long. Perianth-tube 4 inch long, silvery-scaly outside; lobes ovate, acute. Fruit 3—5 inch long, globose or ellipsoid, succulent, red or pale orange,

with scattered silvery scales. Endocarp coriaceous clothed inside with a felt of white hairs.

Occurs throughout the hills between 5,000 and 8,000 feet. Usually in open forest. Fairly common. Flowers: April-May. Fruit: September-October.

2. *Elæagnus latifolia*, Linn.—A subdeciduous shrub with scandent or subscandent stems up to 60 feet high and 3 inches diameter, often producing strong adventitious shoots with rusty-coloured bark, usually armed with straight or recurved thorns $\frac{5}{8}$ —1 inch long. Bark dark brown, fairly smooth or slightly rough with scattered raised circular lenticels. Blaze $\frac{15}{16}$ — $\frac{25}{16}$ inch, pink sometimes mottled towards the outside with sclerotic orange tissue and with peculiar cross-fibred structure. Young shoots densely clothed with silvery scales. Leaves 3—6 by $\frac{1\cdot25}{2\cdot5}$ inches, elliptic, obtuse acute or acuminate, margin undulate, base rounded or acute, densely clothed on both surfaces with silvery scales when young, those on the upper surface ultimately deciduous but persistent beneath, lateral nerves 5—8 pairs. Petiole $\frac{25}{16}$ — $\frac{4}{8}$ inch long, silvery-scaly. Flowers $\frac{2}{8}$ inch diameter, yellow, in axillary usually many-flowered clusters. Pedicels $\frac{1}{8}$ — $\frac{15}{16}$ inch long. Perianth-tube $\frac{15}{16}$ — $\frac{25}{16}$ inch long, silvery-scaly outside; lobes ovate, acute. Fruit $\frac{75}{100}$ — $\frac{1\cdot25}{1}$ inches long, oblong, succulent, red or orange, with scattered silvery scales. Endocarp coriaceous, woolly within.

Occurs in the subhimalayan tract and outermost hill ranges between 1,500 and 2,000 feet. Not common, usually found in swampy localities or bordering streams. Flowers: September (probably). Fruit: March.

2. HIPPOPHÆ, Linn.

Thorny shrubs or small trees. Leaves alternate, narrow. Flowers dioecious. Male flowers sessile, clustered; perianth 2-partite almost to the base, lobes valvate. Stamens usually 4, rarely fewer by abortion, one-seriate, alternating with the angles of a small cushion-shaped disk. Female flowers shortly pedicellate, solitary; perianth-tube distinct; lobes 2, obscure; staminodes none. Stigma oblong-cylindric, oblique, exserted. Fruit succulent containing an utricle.

- | | | | | |
|---|-----|-----|-----|-------------------------|
| A dwarf shrub. Leaves less than 1 inch long, scaly on both surfaces | ... | ... | ... | 1. <i>rhamnoides</i> . |
| A tree. Leaves exceeding 1 inch, more or less stellate-hairy on both surfaces | ... | ... | ... | 2. <i>salicifolia</i> . |

1. *Hippophæ rhamnoides*, Linn. Vern. *Tarwa*, Bhotia.—A stiff densely-branching deciduous shrub 6 inches to 2 feet high with erect or decumbent stems up to 1 inch diameter, the branches frequently dying back at the tips and becoming spinescent. Bark smooth, ashy or silvery-grey, or finally rough and dark brown. Twigs and young shoots more or less densely clothed with silvery-brown scales, the youngest shoots puberulous. Leaves $\frac{35}{100}$ — $\frac{7}{10}$ by $\frac{1\cdot2}{1}$ inch, densely clothed on both

surfaces with silvery-brown scales, chiefly brown on the undersurface, minutely pubescent when young. Petiole 0. Flowers appearing with the new leaves. Perianth-lobes of male flowers orbicular, concave, less than .1 inch long, scaly on the outside. Fruit .3 inch long, globose, scaly, crowned with the persistent style.

Occurs on the dry interior ranges bordering Tibet between 12,000 and 14,000 feet. Fairly common, forming gregarious patches on shingly ground. Flowers: May-June. Fruit: September. The plant here described is a dwarf variety of the typical European plant, which has not been collected in our area.

2. *Hippophæ salicifolia*, Don. Vern. *Amēs* or *Chūk*, NG. *Chu*, EA.—A small deciduous tree up to 8 feet girth and 30 feet high with rounded spreading crown, often spinescent when young. Bark reddish-brown, with deep longitudinal furrows, very rough. Blaze 1 inch, fibrous, pale yellow or yellowish-brown. Twigs clothed with rusty-brown scales. Leaves 1.5—4 by .3—.6 inch, oblong-lanceolate, stellately pubescent above when young becoming bluish-green and with varying amount of pubescence when mature, canescent with dense short stellate tomentum beneath, the midrib beneath pale rusty brown with a few scales mixed with the hairs. Petiole about .1 inch long. Flowers appearing just before or with the young leaves. Perianth of the male flowers scaly. Fruit .25 inch long, ovoid, yellow, with scattered scales, very acid to the taste, remaining long on the tree.

Occurs along the slopes of the main Himalayan range between 5,000 and 10,500 feet. Fairly common on river banks and in damp places. Most of the lateral twigs seem to be deciduous, sometimes dying back to form thorns on young plants. Flowers: April-May. Fruit: October—March.



LXXVII.—LORANTHACEÆ.

Green parasitic shrubs attaching themselves by means of haustoria to the branches of other woody plants. Leaves opposite or alternate, simple, entire, exstipulate, sometimes reduced to scales. Flowers 1-2-sexual, in racemes spikes heads or fascicles. Hypanthium adnate to the ovary and sometimes growing up as an entire or toothed ring (calculus) above it. Perianth sepaloid or petaloid of 4—6 segments free or connate into a tube below, valvate in bud. Stamens as many as the segments, opposite to and usually adnate to them. Ovary inferior, 1-celled; style short or long; stigma simple; ovule solitary. Fruit a 1-seeded berry or drupe with a viscid inner layer.

Flowers bisexual, showy. Leaves opposite or alternate ... 1. *Loranthus*.

Flowers unisexual, inconspicuous. Leaves opposite and 3—5-nerved or 0 ... 2. *Viscum*.

The species of both these genera are commonly known as mistletoes.

1. LORANTHUS, Linn.

Leaves opposite or alternate, usually fleshy or coriaceous with obscure nerves. Flowers bisexual, usually coloured. Hypanthium usually produced into a calculus which is sometimes reduced to a mere rim. Perianth-segments free or perianth forming a split or entire tube below, lobes reflexed or spreading. Stamens epiphyllous; anthers versatile or cells adnate.

I.—Flowers and quite young leaves tomentose. Perianth-lobes much shorter than the tube.

A. Under leaf-surface persistently and densely tomentose ... 1. *vestitus*.

B. Mature leaves glabrous or nearly so.

1. Perianth outside red or orange-red at the base passing into yellowish-green or green. Berry glabrous ... 2. *elatus*.

2. Perianth outside brown-or white-tomentose. Berry stellately pubescent.

(a) Perianth-lobes purplish-red within. Mature leaves very glossy on both surfaces ... 3. *cordifolius*.

(b) Perianth-lobes green within. Mature leaves dull on both surfaces ... 4. *pulverulentus*.

II.—Flowers and quite young leaves clothed with rusty scales. Perianth-lobes equal to the tube ... 5. *ligustrinus*.

III.—Whole plant glabrous.

1. Flowers sessile, .15 inch long ... 6. *odoratus*.

2. Flowers pedicelled, 1.2 inches long ... 7. *longiflorus*.

Besides the above species *L. Scurrula*, Linn. is also, according to Duthie, found along the subhimalayan tract, but I am doubtful about this. Moreover *L. Scurrula* is possibly not specifically different from *L. cordifolius*. According to Duthie the leaves of *L. Scurrula* are smaller, sessile or short-petioled and adpressed-tomentose or glabrate beneath.

1. *Loranthus vestitus*, Wall.—Evergreen. Branches up to 8 feet long and 2 inches diameter, often drooping. Bark dark brown or blackish, rather rough, lenticellate. Young shoots and leaves densely clothed all over with silvery or ferruginous tomentum, the hairs partly stellate and partly feathery-branched, persistent on the under leaf-surface. Leaves opposite, 2—4 by .75—1.75 inches, ovate-lanceolate or oblong, narrowed at both ends, coriaceous, glabrous and glossy dark green above when mature; lateral nerves rather indistinct 5—7 pairs. Petiole .2—.5 inch long. Flowers axillary, in few-flowered, shortly pedunculate, villous fascicles or sometimes solitary. Flower-buds clavate, obtuse. Pedicels 0. Hypanthium scarcely produced above the ovary. Perianth .6—7 inch long, clothed outside with ferruginous scurfy tomentum, cleft about one-third the way down into 4 obtuse lobes which are reflexed and bright green inside. Anthers red. Filaments (both free and attached portions) and style purple. Berry .3—35 inch long, almost cylindric, bright orange. Seed surrounded by a viscid pale grey medium which in the immature fruit is emerald green.

Occurs throughout the hills between 6,000 and 7,500 feet. Abundant and commonly parasitic on *Quercus incana* and *Q. dilatata*. Flowers: September—January. Fruit: May—June.

2. *Loranthus elatus*, Edgew.—Young shoots and leaves densely clothed all over with stellate tomentum, soon becoming glabrous. Leaves opposite and alternate, 2.5—5 by 1.5—3 inches, broadly ovate, acute, base rounded or subcordate, thick, soft, fleshy, bright glossy green or sometimes yellowish with pinkish veins on the undersurface. Petiole .3—6 inch long, very stout. Flowers 1—1.5 inches long, in axillary fascicles or in short racemes up to 1 inch long on the old wood. Peduncle glabrous or rusty-pubescent. Pedicels .1—2 inch long. Flower-buds more or less clavate, blunt. Hypanthium rusty-pubescent. Perianth more or less scurfy-pubescent outside, red or orange-red at the base passing into yellowish-green or green towards the top on the outside, cleft about one third the way down into 4 lobes which are reflexed and green inside. Anthers .15—2 inch long, scarlet. Filaments adnate nearly to the top, purple passing into red below. Style purple. Berry .3 inch long, turbinate, glabrous.

Occurs throughout the hills between 5,000 and 10,000 feet. Parasitic on *Litsea umbrosa* and other trees. Flowers: April—July.

3. *Loranthus cordifolius*, Wall.—Evergreen. Stems up to 5 feet long and 1.25 inches diameter. Bark dark brown, fairly smooth, with very numerous minute pale lenticels. Young leaves and shoots clothed all over with white or buff-coloured scurfy (partly stellate partly feathery)

tomentum. Leaves opposite, usually 2·5—5·5 by 1·5—4 inches, broadly ovate or suborbicular, obtuse, base rounded or subcordate, thick and rather fleshy, glabrous or nearly so and dull green on both surfaces when mature; lateral nerves rather indistinct 5—8 pairs. Petiole ·3—·8 inch long. Flowers ·8—1 inch long, in tomentose fascicles or short racemes ·75 inch long or less, solitary or fascicled in the leaf-axils. Hypanthium scarcely produced above the ovary. Perianth densely clothed outside with scurfy brown tomentum; tube ·6—·7 inch long, first bright green then purplish-red inside between the adnate filaments; lobes 4, acute, reflexed, purplish-red inside. Anthers and free portions of the filaments crimson, adnate portion purplish-red. Style purple. Berry ·25—·3 inch long, obconic, yellow often tinged with red, stellately pubescent. Seed surrounded by a translucent viscid mucilage which is bright emerald green till ripe.

Probably occurs throughout the central and outer hill ranges between 1,000 and 5,000 feet. Flowers: November—March. Fruit: March-April.

4. *Loranthus pulverulentus*, Wall.—Evergreen. Stems up to 3 feet long and 1 inch diameter. Bark dark brown, roughish, with numerous minute raised lenticels. Young leaves and shoots clothed all over with white flocculent fugaceous (partly stellate and partly feathery) tomentum, soon becoming glabrous. Leaves opposite, 3—6 by 1·75—3·5 inches, ovate or oblong, obtuse or acute, base rounded or narrowed into the petiole, thick and rather fleshy, very glossy and dark green on both surfaces. Petiole ·4—·8 inch long. Flowers 1—1·1 inches long, in tomentose solitary or fascicled axillary racemes ·3—2·5 inches long. Pedicels ·1·2 inch long. Hypanthium scarcely produced above the ovary. Perianth densely clothed outside with flocculent white tomentum; tube ·7·8 inch long; lobes 4, reflexed, green inside. Anthers and free portions of the filaments crimson, adnate portion dark purple. Style purple. Berry ·35—·4 inch long, almost or quite cylindric when ripe, green, stellately pubescent. Seed surrounded by a translucent viscid mucilage which is bright emerald green till ripe.

Probably occurs throughout the central and outer hill ranges between 1,000 and 5,500 feet. Fairly common, frequently parasitic on *Mallotus philippinensis*, *Butea frondosa* and *Dalbergia Sissoo*. Flowers: August—May.

5. *Loranthus ligustrinus*, Wall.—Evergreen. Stems up to 6 feet long and 1 inch diameter. Bark reddish-brown, fairly smooth. Young shoots leaves and inflorescence clothed with rusty scales, often densely so. Leaves inconstantly opposite, 1·5—3·5 by ·5—1·2 inches, lanceolate or elliptic, narrowed at both ends, glabrous. Petiole ·2·3 inch long. Flowers ·3 inch long, red, in solitary or paired axillary racemes

up to 1 inch long, often reduced to a single pair of flowers on a peduncle .2 inch long. Flower-buds cylindric, obtuse. Pedicels .05 inch long. Hypanthium with very short truncate limb. Perianth of 4 distinct ligulate lobes, more or less scaly without, reflexed from the middle. Berry .25 inch long, ovoid.

Occurs throughout the central and outer hill ranges between 2,000 and 4,000 feet. Fairly common and found parasitic on many different trees but especially *Mallotus philippinensis*. Flowers: April—June.

6. *Loranthus odoratus*, Wall.—Glabrous. Leaves subopposite, 3—5 inches long, elliptic or lanceolate, fleshy, narrowed into a petiole, often falcate, penninerved, nerves slender. Flowers .15 inch long, yellowish, sweet-scented, opposite or fascicled on axillary, solitary or fascicled spikes 1-2.5 inches long. Hypanthium with short limb. Perianth-lobes 6, about .15 inch long, spatulate, free. Ovary with the base sunk in the hypanthium. Style very stout. Stigma capitate. Berry ellipsoid, glabrous.

I am uncertain whether this species really occurs within our area or not, but there are two sheets at Dehra Dun which seem to agree well with the description given in the F. B. I. though their fragmentary nature makes certain identification difficult. These sheets are Duthie's No. 3361 collected in the Ramganga valley and Osmaston's No. 905 collected at 4,600 feet elevation close to Baijnath.

7. *Loranthus longiflorus*, Desr.—Evergreen. Glabrous. Leaves inconstantly opposite, 3—10 by .7—5 inches, very variable in shape, ovate elliptic or oblong, obtuse, base usually narrowed, thick and fleshy. Petiole .3—7 inch long. Flowers 1-2 inches long, scarlet or orange, in dense one-sided racemes 1-2.5 inches long. Flower-buds cylindric, acute. Pedicels .1—1.5 inch long. Hypanthium with a distinct broadly tubular calyculus, truncate or wavy. Perianth glabrous, cleft about one third to one quarter the way down into 5 reflexed lobes, green inside. Berry .3—5 inch long, ovoid-oblong, crowned with the cup-shaped calyculus.

Occurs throughout the subhimalayan tract and outer hill ranges up to 3,000 feet. Very common and parasitic on many different species of trees. Flowers almost throughout the year.

2. *VISCUM*, Linn.

Leaves opposite or reduced to scales. Flowers small or minute, dioecious or moncecious, solitary or fascicled. Hypanthium solid or hollow in the male, adnate to the ovary in the female. Perianth-segments 3-4, green or yellow. Anthers sessile, adnate to the perianth-segments. Stigma large, pulvinate. Fruit a succulent berry.

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|---|-----|-----|-------------------------|
| I.—Leafy. Upper joints of stem terete | ... | ... | 1. <i>album</i> . |
| II.—Leafless. Upper joints of stem flattened. | | | |
| 1. Joints .75—2.2 inches long, striate | ... | ... | 2. <i>articulatum</i> . |
| 2. Joints .2—7 inch long, not striate | ... | ... | 3. <i>japonicum</i> . |
| III.—Leafless. All joints terete | ... | ... | 4. <i>sp.</i> |

1. *Viscum album*, Linn Eng. Mistletoe.—Evergreen, forming bushy tufts 2-3 feet across. Stems terete, up to .5 inch diameter, bright green or yellowish-green. Branches jointed, dichotomous. Leaves variable, usually 1-2 inches long, oblong, broad or narrow, usually with obtuse tip and cuneate base, glabrous, thick and fleshy, bright green or yellowish-green, obscurely 3—5-nerved, sessile. Flowers dioecious, sessile, in clusters of 3 or 5 in the forks of the branches, supported by cup-shaped slightly ciliate bracts; terminal flower solitary, the lateral in opposite or decussate pairs. Perianth-segments 3-4, triangular, thick, acute, deciduous. Berry .3 inch diameter, subglobose, white, translucent.

Occurs throughout the hills between 3,000 and 7,500 feet. Fairly common, the host usually being one of the *Rosaceæ*. Flowers: March—May. Fruit: November—January.

2. *Viscum articulatum*, Burm.—Leafless, forming rounded bushy tufts. Stems jointed, smooth, greenish, up to 2 feet long and .5 inch diameter, flattened at first, ultimately terete. Upper joints .75—2.2 inches long by .15—.4 inch broad, bright green, indistinctly ribbed, widening slightly from the base upwards. Flowers monœcious, sessile, in clusters of 3 at the nodes, the lateral flowers usually male. Bracts cup-shaped. Perianth-segments triangular, erect in female, spreading in male flowers, deciduous. Berry .2 inch long, ovoid, yellowish-green. Seed bright green surrounded by a viscid transparent fluid.

Occurs in the Bhabar and central and outer hill ranges between 1,000 and 7,500 feet. Parasitises a great variety of plants. Often found growing on *Loranthus vestitus*, Wall. Flowers: June—October. Fruit: May-June.

3. *Viscum japonicum*, Thunb.—Leafless, forming dense much-branched tufts. Stems jointed, smooth, yellowish-green, up to 7 inches long and .2 inch diameter, flattened at first, ultimately terete. Upper joints .2—.7 inch long by .05—.2 inch broad, widening from the base upwards. Flowers as in *V. articulatum* but segments of the perianth persistent. Berry .05—.1 inch long, ellipsoid, yellowish-green. Seed surrounded by a viscid transparent fluid.

Occurs throughout the hills between 6,000 and 7,000 feet. Fairly common and chiefly parasitic on *Quercus incana*. A severe attack may kill the tree. Flowers: May—July. Fruit: October-November.

4. *Viscum* sp.—Leafless, forming tufts branching in all directions. Stems jointed, conspicuously ribbed, green, 1.5-6 inches long and up to .2 inch diameter. Joints .15—1 inch long, terete not flattened even when young, somewhat thickened at both ends. The whole plant including the perianth very papillose. Flowers minute, sessile, densely

clustered at the nodes, at first half-enclosed by the two connate persistent bracteoles. Perianth-segments erect, triangular, deciduous. Berry .15 inch diameter, globose, white. Seed green, somewhat flattened, surrounded by opaque white viscous mucilage.

Probably occurs along the whole outer ranges of hills between 2,000 and 5,000 feet but it seems to be rare. It is found parasitic on *Loranthus cordifolius*, Wall, and *Loranthus pulverulentus*. Wall. Flowers: November-December. There are three sheets of this species at Dehra Dun namely my no. 1291 and Dehra Dun Herb. nos. 26008 and 23028 collected by Inayat and P. W. Mackinnon all from the outer Himalaya.

LXXVIII.—SANTALACEÆ.

Trees shrubs or herbs often more or less parasitic on roots. Leaves alternate or opposite, entire, sometimes scale-like or none, nerves inconspicuous, exstipulate. Flowers 1-2-sexual, regular, usually inconspicuous, mostly cymose. Perianth superior or perigynous, 3—8-toothed, -lobed or-partite, lobes with often a tuft of hair behind the anthers. Stamens 3—6, often adnate to the lobes, rarely at the base of the perianth opposite to the lobes; anthers 2-celled. Disk perigynous or epigynous. Ovary nearly free or usually adnate to the hypanthium, 1-celled; style usually short; stigma entire or 3—6-lobed; ovules 2—4, rarely solitary. Fruit a drupe or nut.

Parasitic on roots. Leaves penninerved ... 1. *Osyris*.

Parasitic on branches. Leaves 5—9-nerved from the base 2. *Henslowia*.

1. OSYRIS, Linn.

Glabrous shrubs. Leaves alternate. Flowers small, axillary, polygamous; male flowers in clusters, the bisexual often solitary. Perianth-tube solid in male flowers, of the bisexual flowers adnate to the ovary; lobes 3-4, with a tuft of hairs on the face. Stamens 3 or 4, inserted at the base of the perianth-lobes. Disk angular. Ovary sunk in the perianth-tube; style short; stigma 3-4-fid; ovules 2—4. Fruit a 1-seeded globose or ovoid drupe.

Osyris arborea, Wall. Vern. *Bakröl*, NG.—An evergreen glabrous shrub usually 4—8 feet high but attaining 15 feet with stems up to 4 inches diameter. Bark dark brown, slightly rough. Blaze 1—2½ inch, not fibrous, bright pink or purplish-red. Twigs green, sharply 3-angled. Leaves 1-2 by ½—1 inch, variable in shape, elliptic-lanceolate or obovate-oblong, obtuse or acute, mucronate, base cuneate, rather thick, dull glaucous green on both surfaces, lateral nerves indistinct 4—8 pairs, sessile. Flowers greenish-yellow; males in axillary 5—10-flowered umbels, peduncles 3—5 inch long, often arranged in short racemose panicles; bisexual 1—1½ inch diameter, solitary, on slender axillary pedicels 2-3 inch long, lengthening in fruit. Perianth-limb 3-lobed. Drupe 3—3½ inch diameter, globose, succulent, orange-red, crowned by the disk.

Occurs throughout the hills between 3,000 and 6,500 feet. Fairly common in open types of forest but especially in secondary dry miscellaneous scrub. Parasitic on the roots of other plants. Flowers more or less all the year round.

2. HENSLOVIA, Blume.

Parasitic shrubs. Leaves alternate. Flowers minute, monoecious or dioecious, axillary, or the females with stamens; males subracemose or capitellate; females solitary or few and clustered. Perianth-tube of male flowers nil, of female flowers adnate to the ovary; lobes 5-6, valvate. Stamens 5 or 6, short, inserted at the base or middle of the lobes. Disk concave or convex. Ovary inferior; stigma sessile, discoid or lobed; ovules 2-3. Fruit a drupe, endocarp hard.

Henslovía heterantha, Hook. f. and T.—A small glabrous parasitic shrub. Branches erect or spreading. Bark rough, usually pale brown. Twigs often minutely pustular. Leaves alternate, very variable, 1—4 inches long, elliptic ovate or orbicular, base narrowed into the petiole, 5—9-nerved. Petiole .2—·5 inch long, winged in continuation with the lamina. Flowers minute, unisexual, sessile on the top of solitary or clustered lateral peduncles which are bracteate at the base and tip only, the bracts at the tip forming a spreading involucre. Peduncles not exceeding .05 inch long in flower, lengthening to nearly .15 inch in fruit. Male flowers numerous, perianth 5- or 6-lobed. Stamens 5 or 6. Female flowers 1 or few, perianth 5- or 6-lobed, without or with very imperfect stamens. Drupe about .15 inch long, elliptic-oblong.

Occurs in the central and outer ranges between 3,000 and 5,000 feet. Fairly common in the eastern Divisions but not recorded west of Ratwadhah in the Kalagarh Division. It is found on many different hosts and has the habit of a *Loranthus*. Flowers: December-January. Fruit: June.

LXXIX.—EUPHORBIACEÆ.

Trees shrubs or herbs, rarely climbing, sometimes with fleshy branches, often with milky juice. Leaves alternate or opposite, usually simple, usually stipulate. Inflorescence various. Flowers unisexual, usually small. Perianth often small or none, usually calyciform, sometimes well developed and with differentiated calyx and corolla. Calyx inferior. Petals free. Perianth or petals sometimes different in the two sexes. Disk hypogynous, variously formed. Male flowers with stamens isomerous with the sepals or petals or fewer or numerous. Female flower with or usually without staminodes. Ovary mostly 3-celled, rarely more or less; style none or 1 with as many branches as the cells; stigmas various; ovules 1 to 2 in each carpel. Fruit normally a 3-celled capsule becoming 3-coccous and falling away from a persistent columella, sometimes a berry or drupe.

- | | |
|---|-------------------------------|
| 1. Branches thick and fleshy, with a copious milky juice | 1. <i>Euphorbia</i> . |
| Branches not thick and fleshy ... | 2. |
| 2. Leaves trifoliolate ... | 14. <i>Bischoffia</i> . |
| Leaves simple ... | 3. |
| 3. Leaves opposite ... | 4. |
| Leaves alternate ... | 5. |
| 4. Leaves thick, evergreen less than 3 inches long | 3. <i>Buxus</i> . |
| Leaves thin, deciduous, more than 6 inches long | 18. <i>Trewia</i> . |
| 5. Leaves closely dotted beneath with red or yellow glands | 6. |
| Leaves not gland-dotted beneath | 7. |
| 6. Glands red | 19. <i>Mallotus</i> . |
| Glands yellow | 20. <i>Macaranga</i> . |
| 7. Leaves peltate | 21. <i>Ricinus</i> . |
| Leaves not peltate | 8. |
| 8. Petiole pink, 1—3 inches long, tumid at its junction with the blade. | 15. <i>Daphniphyllum</i> . |
| Petiole not as above | 9. |
| 9. Petiole usually exceeding 2·5 inches long | 10. |
| Petiole not exceeding 2·5 inches long | 11. |
| 10. Leaf-base 7-nerved | 17. <i>Jatropha</i> . |
| Leaf-base 3—5-nerved | 22. <i>Baliospermum</i> . |
| 11. Stems and leaves with milky juice | 12. |
| No milky juice | 13. |
| 12. Leaves 3—5 inches long | 24. <i>Excoecaria</i> . |
| Leaves 8—16 inches long | 23. <i>Sapium (insigne)</i> . |
| 13. Leaves not exceeding 5 inch long | 14. |
| Leaves exceeding 5 inch long | 15. |

14. A small shrub. Fruit capsular	...	...	6. <i>Phyllanthus</i> .
A tree. Fruit drupaceous	...	...	8. <i>Emblica</i> .
15. Leaves obscurely serrulate	...	...	12. <i>Putranjiva</i> .
Leaves entire	...	...	16.
16. A tree with smooth pale bark which is scurfy or corky	...	...	13. <i>Cyclostemon</i> .
on the outside	...	...	17.
Not as above	...	...	2. <i>Sarcococca</i> .
17. A shrub with shiny dark green narrowly lanceolate	...	...	18.
leaves 1—3 inches long	...	...	16. <i>Antidesma</i> .
Not as above	...	...	19.
18. Shrubs with flowers in simple or paniced racemes	...	...	20.
more than 1 inch long	...	...	23.
Not as above	...	...	21.
19. Trees	...	...	22.
Shrubs	...	...	4. <i>Bridelia</i> (<i>retusa</i> and <i>verrucosa</i>).
20. Flowers in racemes	...	...	23. <i>Sapium</i> (<i>sebiferum</i> and <i>eugeniaefolium</i>).
Flowers in clusters	...	...	7. <i>Prosoros</i> .
21. Lateral nerves exceeding 10 pairs	...	...	10. <i>Glochidion</i> (<i>assamicum</i>).
Lateral nerves not exceeding 10 pairs	...	...	4. <i>Bridelia</i> (<i>stipularis</i> and <i>verrucosa</i>).
22. Bark smooth, pale	...	...	24.
Bark rough, not pale	...	...	5. <i>Andrachne</i> .
23. Lateral nerves 8 or more pairs	...	...	25.
Lateral nerves not exceeding 8 pairs	...	...	10. <i>Glochidion</i> (<i>velutinum</i>).
24. Petiole usually exceeding .5 inch long	...	...	26.
Petiole not exceeding .5 inch long	...	...	11. <i>Fluggea</i> .
25. Leaves over 3 inches long	...	...	9. <i>Kirganelia</i> .
Leaves under 3 inches long	...	...
26. Branchlets persistent. Flowers dioecious	...	...
Branchlets deciduous. Flowers monoecious	...	...

1. EUPHORBIA, *Linn.*

Herbs, shrubs or trees with milky juice; branches often thick and fleshy. Leaves opposite or alternate; stipules often reduced to spines or none. Inflorescence composite. Male flowers of naked pedicelled stamens usually many together, frequently in 5 groups, in a calyx-like 4-5-lobed involucre, the lobes thin, sepaloïd, entire or divided, alternating with large, rarely small, glandular processes forming an outer whorl, or in some cases glands solitary, and sometimes furnished with a petaloïd expansion or limb or with horns. Involucres 1-sexual or usually 2-sexual, containing a solitary central female flower consisting of a pedicelled ovary, naked or sometimes with rudiments of a 3-merous calyx. Ovary 3-celled, more or less deeply 3-lobed; styles 3, free or connate; ovule 1 in each cell. Capsule of three 2-valved cocci.

Euphorbia Royleana, Boiss. Vern. *Surai*, G.—A deciduous shrub or small tree attaining 5 feet girth and 20 feet high. Branches whorled, 5—7-angled, the ridges wavy with a pair of stipular spines 2·3 inch long at the crest of each wave. Leaves alternate, 4—6 inches long, spatulate, mucronate, very thick and fleshy, sessile. Involucres 5 inch across, yellowish-green, in compact sessile 3-flowered cymes arising from the sinus between the nodes. Capsule 6 inch diameter, pale grey, 3-lobed, pedunculate.

Occurs throughout the area between 2,000 and 4,000 feet. Often abundant on dry rocky or exposed situations, especially on southern aspects where it tends to become gregarious. The leaves appear during the rains and fall soon afterwards. Flowers: March—May.

2. SARCOCOCCA, Lindl.

Evergreen glabrous shrubs. Leaves alternate, coriaceous, entire, penni- or triple-nerved. Flowers monœcious, apetalous, bracteate in short axillary racemes. Disk 0. Male flowers: sepals 4, biseriate, imbricate. Stamens 4, opposite the sepals, free. Female flowers: sepals 4 or 6, biseriate, imbricate. Ovary 2-3-celled; styles short, entire; ovules 2 in each cell. Fruit indehiscent, coriaceous or fleshy: endocarp hard. Seeds 1-2.

Sarcococca saligna, Muell. Syn. *S. pruniiformis*, Lindl. Vern. *Paliāla* or *Ġēru*, NG.—An erect evergreen shrub 2—6 feet high with stems up to 75 inch diameter. Bark smooth, green. Leaves 2·5—5·5 by 3—1 inch, lanceolate or linear-lanceolate, long-acuminate, base narrowed, glabrous, shining dark green above. Petiole 2—4 inch long. Flowers fragrant, green or yellowish-green, in short axillary racemes of about 4—10 flowers either all of one sex or male above and female below. Perianth 15—2 inch diameter. Stamens usually 4, conspicuous, more than twice as long as the perianth. Fruit a drupe 3·4 inch long, ovoid, black when ripe.

Occurs throughout the hills between 4,500 and 8,500 feet. A common and often gregarious shrub in oak, spruce and cypress forests, preferring moist and shady localities. Flowers: October—May. Fruit: October—January.

3. BUXUS, Linn.

Evergreen shrubs or trees. Leaves opposite, coriaceous, entire, penninerved. Flowers monœcious, in very short erect dense axillary racemes. Male flowers ebracteate; sepals 4, in 2 series, imbricate; stamens as many as the sepals and opposite them, free; ovary rudimentary. Female flowers; sepals 6, the 2 outer much smaller, imbricate; ovary 3-celled; ovules 2 in each cell; styles 3, short, thick. Capsule ovoid, tipped by the persistent styles, loculicidally 3-valved, valves

2-horned by the split styles, endocarp splitting away from the coriaceous exocarp.

- A tree. Leaves exceeding 1 inch long ... 1. *Wallichiana*.
 A dwarf shrub. Leaves not exceeding .5 inch long ... 1(a). Var. *microphylla*.

1. **Buxus Wallichiana**, Baill. Syn. *B. sempervirens*, Linn. *ex parte*. Vern. *Pāpri*, Gen. Eng. Himalayan Box.—A small evergreen tree up to 5 feet girth and 30 feet high. Bark pale or dark brown, rough, exfoliating in small corky scales. Blaze .2—·5 inch, pale yellow, not or scarcely fibrous. Twigs pubescent when young. Leaves 1·2·5 by .3—·5 inch, lanceolate or narrowly elliptic-oblong, obtuse, bright glossy green above, midrib minutely hairy above and towards the base beneath, otherwise glabrous. Petiole .05—·1 inch long, pubescent. Flowers greenish-yellow, in very short erect dense axillary racemes about .3 inch long, subglobose, terminal flower female. Capsule .4·5 inch long including the horns formed from the persistent styles, broadly ovoid, chestnut-brown when ripe. Seeds oblong, black, shining, .25 inch long.

Occurs on the central and inner ranges, more especially the latter, between 6,000 and 9,000 feet. Never common and distribution somewhat local, generally in moist and shady localities. Flowers: March—May. Fruit: June—August.

1(a) **Var. microphylla**, Hook f.—A dwarf evergreen shrub. Bark rough, corky. Twigs sparsely clothed with minute hairs when young. Leaves .25—·5 by .15—·25 inch, orbicular or oblong, obtuse or rounded, thick, glabrous, shining, the secondary nerves practically invisible on the upper surface. Petiole about .05 inch long, glabrous or nearly so. Flowers greenish-yellow, in very short erect dense terminal and axillary racemes .1·2 inch long, subglobose, the terminal flower female. Capsule .25—·35 inch long including the horns formed from the persistent styles. Seeds oblong, black, shining, .15 inch long.

Occurs along the interior valleys of North Almora between 10,000 and 12,000 feet. It is found growing in crevices in the rocks. Flowers: June-July. Fruit: September.

4. *BRIDELIA*, Willd.

Trees or shrubs, sometimes climbing. Leaves alternate, entire, with strong parallel secondary nerves. Flowers small, monoëcious, or dioecious in axillary clusters, or clusters in simple or paucicled spikes. Sepals 5, valvate, persistent. Petals 5, usually small, inserted under the margin of the disk. Disk conspicuous and furnished in the female with a corona from the inner margin which often closely invests the ovary and is toothed or lobed. Stamens 5, on a distinct gonophore with a pistillode. Ovary 2-celled; styles 2, free or partially connate, often 2-lobed. Fruit

a drupe with a 2-celled stone, ultimately splitting into two 1-seeded pyrenes.

I. Erect trees or shrubs.

1. Lateral nerves straight. Flower-clusters mostly arranged in axillary or terminal paniculate spikes up to 8 inches long in fruit ... 1. *retusa*.
2. Lateral nerves more or less arched. Flower-clusters axillary, not exceeding 1 inch long in fruit ... 2. *verrucosa*.

II.—A shrub with long rambling sometimes subscandent branches ... 3. *stipularis*.

1. ***Bridelia retusa*, Spreng.** Vern. *Goli*, R and K.—A small or medium-sized deciduous tree bearing stout straight conical spines up to 2 inches long when young and attaining 6 feet girth and 60 feet high. Bark dark brown, rather rough with numerous shallow cracks, exfoliating in thin irregular woody or somewhat corky scales. Blaze 4—6 inch, very fibrous, pink to deep reddish paling towards the interior, juice turning purple on the blade of a knife. Leaves 5—8 by 3-4 inches, elliptic-oblong or somewhat obovate, acute, entire or slightly crenulate, base rounded, shining dark green and usually glabrous above, glaucous and pubescent beneath; lateral nerves 15—28 pairs, prominent, straight. Petiole 2—5 inch long. Flowers dioecious and monœcious, greenish-yellow, in small clusters which are solitary and axillary or arranged in axillary or terminal often paniculate spikes up to 8 inches long in fruit. Drupe 3—45 inch diameter, globose, greenish-yellow when ripe.

Occurs in the Bhabar and subhimalayan tract up to 3,000 feet, but is not recorded from any distance within the hills. One of the common associates of *sal*. Flowers: May—July. Fruit: January-February.

2. ***Bridelia verrucosa*, Haines.** Syn. *B. montana* Hook, f. *ex parte non* Willd. Vern. *Gaya*, G.—An evergreen shrub or small tree with low spreading crown, attaining 4 feet girth and 30 feet high, not spinous. Bark dark brown, rather rough, exfoliating in small irregular woody scales. Blaze 3—5 inch, very fibrous, deep pink or reddish with numerous minute whitish fibres, juice turning purple on the blade of a knife. Leaves 3—8 by 1.5—5 inches, usually elliptic-obovate sometimes elliptic or oblong, base rounded or somewhat narrowed, entire or sinuate, rather glossy above glaucescent beneath, glabrous or nearly so; lateral nerves 10—20 pairs, more or less arched. Petiole 2—5 inch long. Flowers monœcious and dioecious, greenish-yellow, in small axillary clusters not exceeding 1 inch long in fruit. Drupe .25 inch long, ellipsoid.

Occurs throughout the area between 1,000 and 4,500 feet. A common species especially in deep ravines where it not infrequently attaches itself to precipitous cliffs. It is more often seen as a shrub. Young leaves often tinged brownish-pink. Flowers. November—February.

3. *Bridelia stipularis*, Blume. Vern. *Kangia-bel*, H. A large evergreen climber or sarmentose shrub with stems up to 40 feet high and 9 inches diameter. Branches often with long deflexed spines. Bark rough, dark grey or brown. Blaze 2—4 inch, very fibrous, pink, the tissue separating into thin flat lamellæ. Leaves entire, subcoriaceous, 4—7 by 2·25—4 inches (much smaller when subtending flower-clusters), elliptic-oblong or obovate, obtuse or subacute, rounded or cordate at the base, glabrous or puberulous above, fulvous-tomentose beneath, margin sometimes sinuate or uneven; main lateral nerves 8—15 pairs, slightly arching, the transverse veins parallel and at right angles. Petiole 3·4 inch long. Flowers monœcious, greenish-yellow, in small dense axillary clusters or long spikes, male flowers sessile, females pedicelled. Drupe 4·5 inch long, ovoid, black when ripe.

Occurs in the subhimalayan tract up to 1,000 feet, but not recorded west of Haldwani. Flowers: October—December. Fruit: March—May.

5. ANDRACHNE, Linn.

Herbs or small shrubs. Leaves alternate, entire. Flowers monœcious; males clustered in the axils; females solitary. Male flowers: perianth usually double. Calyx 5-6-lobed or-partite. Petals 5-6 or 0. Glands of disk as many or twice as many as the petals. Stamens 5-6. Pistillode small. Female flowers: calyx-segments usually larger than in males. Petals minute or 0. Ovary 3-celled; ovules 2 in each cell; styles short, 2-fid or 2-partite. Fruit a capsule of three 2-valved cocci.

Andrachne cordifolia, Muell. Arg. Vern. *Bhatula*, G.—An erect deciduous or subdeciduous shrub 4—8 feet high with stems up to 1 inch diameter. Bark smooth, very pale brown or ashy with rather conspicuous circular lenticels. Twigs slender, green. Leaves 1—4 by 5—1·8 inches, elliptic or ovate, the larger oblong, rounded at both ends, membranous, glabrous above, thinly pubescent beneath. Petiole slender 3—1·3 inches long. Flowers 2·3 inch diameter, green, the calyx persisting in the female and enlarged to 4 inch diameter in fruit. Pedicels 5—1·5 inches long, very slender. Capsule 3 inch diameter, depressed-globose, obscurely 3-lobed, dark brown.

Occurs throughout the hills between 2,000 and 8,000 feet. Common and found in almost any locality but preferring shade. Flowers: May—September. Fruit: January.

6. PHYLLANTHUS, Linn (modified).

Shrubs or herbs. Leaves small, alternate, distichous, stipulate, often deciduous with the branchlets which resemble pinnate leaves. Flowers small, monœcious, in axillary clusters or subsolitary, apetalous; females with usually accrescent perianth and larger than males. Sepals

5-6, imbricate, in 2 series. Disk in male of minute glands; in female of glands or expanded and often lobed. Stamens 3; filaments united into a short column. Ovary 3-celled. Styles 3, free or connate at the base, bifid or bilobed. Fruit of three 2-valved cocci, rarely with a subsucculent epicarp.

Phyllanthus parvifolius, *Buch.-Ham.*—An erect bushy deciduous or subdeciduous shrub 1—6 feet high with stems up to $\frac{1}{4}$ inch diameter. Twigs slender, usually tinged purple or red. Leaves $\frac{25}{16}$ — $\frac{5}{8}$ by $\frac{15}{16}$ — $\frac{3}{8}$ inch, obovate or elliptic-oblong, entire, glabrous, subsessile. Flowers $\frac{1}{8}$ inch across, the female slightly larger, brownish-purple, solitary or few together in the leaf-axils. Pedicels very slender, $\frac{1}{8}$ — $\frac{3}{8}$ inch long. Fruit a capsule $\frac{15}{16}$ — $\frac{1}{2}$ inch diameter, depressed-globose, with a thin juicy epicarp which turns first red then purplish-black when ripe.

Occurs throughout the hills between 5,000 and 6,500 feet. Fairly common in open *banj* forest, also sometimes on open rocky ground. The leaves turn reddish-purple before falling. Flowers: June—October. Fruit: October—December.

7. PROSORUS, *Dalz.*

Small trees with deciduous branchlets. Leaves alternate. Flowers small, dioecious, apetalous, in clusters, mostly below the leaves, in the axils of caducous bracts on the new shoots. Sepals 4, imbricate, in 2 unequal pairs. Disk of male large, flattened, faintly lobed, sometimes narrower in the female. Stamens 4, opposite the sepals from inside the disk. Styles 3, stout, spreading, 2-fid. Fruit with thin dry epicarp, bursting irregularly, and enclosing 3 thin-walled 2-valved cocci.

Prosorius indicus, *Dalz.* Syn. *Phyllanthus indicus*, *Muell. Arg.*—A small tree up to 5 feet girth and 60 feet high. Bark quite smooth, pale grey or whitish, exfoliating in thin irregular woody plates thus exposing the cinnamon-coloured bark beneath. Blaze $\frac{2}{5}$ — $\frac{5}{8}$ inch, pink, not fibrous. Twigs reddish-brown with small pale lenticels. Young shoots glabrous. Blaze $\frac{25}{16}$ inch white. Leaves $3\frac{5}{8}$ —8 by $1\frac{7}{8}$ — $2\frac{7}{8}$ inches, broadly elliptic or oblong, obtuse or shortly acuminate, base rounded or obtuse, entire, glabrous; secondary nerves 8—14 pairs. Petiole glabrous, $\frac{2}{3}$ inch long. Stipules lanceolate, $\frac{1}{8}$ — $\frac{15}{16}$ inch long. Flowers green, the female $\frac{1}{8}$ — $\frac{15}{16}$ inch diameter, the male smaller, in clusters mostly below the leaves on the new shoots, appearing with the young leaves. Pedicels slender, up to $\frac{5}{8}$ inch long in the female and $\frac{25}{16}$ inch in male flowers. Fruit a glabrous capsule, $\frac{1}{4}$ inch diameter, depressed-globose.

Occurs in swamps and bordering streams in the Bhabar and subhimalayan tract as far west as the Kalagarh Division. In the Haldwani Division it is not uncommon. Flowers: March-April.

8. EMBLICA, Gärtn.

Trees. Leaves small, alternate, distichous, stipulate, often deciduous with the branchlets which resemble pinnate leaves. Flowers minute, monœcious, apetalous, axillary and from axils of scales below the leaves. Female flowers chiefly in the lower axils but mixed with the males and with shorter pedicels. Sepals 5-6, usually, 6, imbricate. Filaments connate into a slender column; anthers 3, free, but broad connectives connivent back to back. Disk none, or of distinct glands in the male, cupular in the female. Ovary 3-celled; styles more or less connate below, 2-3-fid or twice 2-fid above. Fruit a drupe with woody, 3-celled endocarp.

Emblica officinalis, Gärtn. Syn. *Phyllanthus Emblica*, Linn. Vern. *Aonla*, Gen.—A small or medium-sized deciduous tree attaining 7 feet girth and 50 feet high. Bark pale pinkish-or greenish-brown, fairly smooth, peeling off in irregular thin woody scales and giving a rough appearance to old stems, the newly exposed bark paler and yellowish. Blaze 2-3 inch, cheesy, not fibrous, deep reddish-or purplish-brown with very fine parallel striations, juice turning blue on the blade of a knife. Leaves 4-5 by 1 inch, linear-oblong, entire, obtuse, glabrous, subsessile, arranged distichously on slender deciduous branchlets. Flowers minute, greenish, in axillary fascicles on the leafy twigs, often on the naked portion below the leaves. Pedicels .05 inch long. Drupe globose, 7 inch diameter, smooth, pale yellow often tinged with pink, fleshy containing a large stone.

Occurs throughout the area up to 5,000 feet. Common in miscellaneous forest, also in open *sal*. Flowers: March—May. Fruit: November—January.

9. KIRGANELIA, Baill.

Slender usually sarmentose shrubs. Leaves small, alternate, stipulate, often deciduous with the branchlets. Flowers small monœcious, in axillary few-flowered clusters, sometimes paired, apetalous. Male sepals 5, imbricate, 3 inner often larger and sub-petaloid; disk of 5 fleshy glands; stamens 4—7 usually 5, free or connate. Female flower like the male in size, perianth and disk glands. Ovary 5—12-celled with sessile stigmas. Fruit baccate with fleshy exocarp and softly coriaceous 5—12-celled endocarp.

Kirganelia reticulata, Baill. Syn. *Phyllanthus reticulatus*, Poir.—A sarmentose or subscandent shrub 5—15 feet high with stems up to 4 inches diameter. Bark of twigs reddish with numerous small lenticels, of old stems dark brown, fairly smooth. Blaze 1-2 inch, somewhat fibrous, bright pink or reddish with or without paler streaks. The long

slender glabrous or pubescent branches bear numerous deciduous branchlets 2—11 inches long which resemble pinnate leaves and are seated on a woody trifid subspinous pulvinus. Leaves .5—1.75 by .25—.75 inch, elliptic or oblong, membranous, glabrous or hairy, rather glaucous; main lateral nerves 6—8 pairs, indistinct. Petiole .05—.15 inch long. Stipules shorter than the petiole. Flowers green or purple, about .15 inch diameter, male and female sub-similar on slender pedicels .15—.25 inch long, usually one male and one female in each leaf-axil. Berry .2 inch diameter, subglobose, purplish-black when ripe. Seeds usually 8—10 surrounded by pulp.

Occurs along the right bank of the Sarda River in the Haldwani Division but not recorded further west. It is also commonly found growing with *khair* and *sissu* on the Sardi islands. Flowers and fruit most of the year but chiefly February—May.

10. GLOCHIDION, *Forst.*

Trees or shrubs, usually evergreen. Leaves alternate, entire. Flowers small, in axillary clusters, usually monœcious, apetalous. Male flowers with 6, rarely 5, spreading sepals in two series; anthers 3—12, connivent or connate in a sessile or subsessile column, connectives more or less produced with free or connate tips. Disk none. Pistillodes usually none. Females: calyx shortly tubular, 6-toothed or-cleft, or sepals 2-seriate, nearly free. Ovary 3—15-celled; styles connate in a column, lobed or toothed at the tip; ovules 2 in each cell. Fruit a capsule of 3 or more 2-valved cocci, lobes of fruit often twice as many as the cells.

Leaves pubescent	...	...	...	1. <i>velutinum</i> .
Leaves glabrous	...	...	...	2. <i>assamicum</i> .

1. *Glochidion velutinum*, *Wight*. Vern. *Kath-mahwa*, G. *Katmalu*, A.—An erect deciduous or subdeciduous shrub or small tree attaining 5 feet girth and 20 feet high. Bark rough, dark brown or blackish. Bark of branches pale brown with rather deep and close longitudinal fissures giving it a striated appearance. Blaze .3—.5 inch, fibrous, pink. Leaves 3.5—5.5 by 2—2.75 inches, broadly elliptic or oblong, acute or shortly acuminate, puberulous above, pubescent or tomentose beneath; lateral nerves 5—9 pairs. Petiole .05—.15 inch long. Flowers .2 inch across, monœcious, both sexes together in axillary fascicles. Male flowers yellow, on slender pedicels .5 inch long. Female flowers green, on stout pedicels .1 inch long. Capsule .4 inch across, orbicular, depressed, usually 8-lobed. Seeds bright red.

Occurs throughout the area from 1,000 to 6,500 feet. Scarce in the Bhabar, but abundant throughout the hills especially in *chir* and miscellaneous forests. Flowers: April—June. Fruit: August–September.

2. *Glochidion assamicum*, Hook. f.—A small tree attaining 4 feet girth and 40 feet high. Bark reddish-brown, somewhat rough with numerous shallow longitudinal cracks, peeling off in thin soft flakes. Blaze .2—'4 inch, shortly fibrous, pinkish sometimes mottled with purplish-brown. Leaves 3—6 by 1'4—2 inches, elliptic-oblong or lanceolate, coriaceous, glabrous, dark glossy green above, pale and somewhat glossy beneath, acuminate; main lateral nerves prominent beneath, 6—9 pairs. Petiole .1—'2 inch long. Flowers in axillary clusters. Male flowers greenish-yellow, .15—'25 inch across, on slender pedicels .5—'8 inch long. Anthers 3. Capsule .3—'5 inch diameter, depressed, usually 8-lobed.

Occurs in the subhimalayan tract and valleys in the outer hills up to 2,000 feet. It is found exclusively in moist localities bordering streams and in swamps but is rather scarce. Flowers: April-May. Fruit: November-December.

11. FLUGGEA, Willd.

Shrubs, sometimes thorny. Leaves alternate, small, entire. Flowers minute, dioecious, axillary and clustered in the leaf-axils or females sub-solitary, apetalous. Sepals 5, imbricate. Male flowers: stamens 5, free, alternating with 5 fleshy disk-lobes or glands; pistillode small. Female flowers with an annular toothed disk, ovary 1—3-celled; styles 3, long, recurved, entire or 2-lobed above; ovules 2 in each cell. Fruit globose, dry or with white fleshy epicarp, finally dehiscing into three 2-valved cocci or bursting irregularly.

Fluggea microcarpa, Blume. Vern. *Athaina* Gen.—An evergreen shrub with spreading branches and stems up to 6 inches diameter and 20 feet high. Strong adventitious shoots are often produced and these frequently bear straight stout spines 1-2 inches long. Bark pale pinkish-brown and fairly smooth, but becoming dark and rough on very old stems. Blaze .2 inch, scarcely fibrous, pink. Leaves 1—3 inches long, suborbicular, obovate or elliptic, glabrous, somewhat glaucous beneath; lateral nerves slender, 5—7 pairs. Petiole slender .1—'5 inch long. Flowers yellowish-green, less than .1 inch across. Male flowers in dense clusters on filiform pedicels up to .4 inch long. Female flowers in lax fascicles on somewhat shorter pedicels than the male. Fruit of two kinds; mostly dry, .15 inch diameter, obscurely 6-lobed; a few .3 inch diameter, white, succulent.

Occurs throughout the area between 1,000 and 4,000 feet. Fairly common in secondary miscellaneous forest. Flowers: May-June.

12. PUTRANJIVA, Wall.

Trees. Leaves alternate, entire or serrulate, penninerved. Flowers inconspicuous, monoecious or dioecious, apetalous; males clustered,

axillary, or at the axils of caducous bracts on the new shoots; females long-peduncled, usually solitary, axillary. Disk none. Calyx 3—6-lobed or -partite; lobes unequal, imbricate. Male with 2—4 central stamens; filaments free or partially connate. Female with 2-3-celled ovary and as many styles; ovules 2 in each cell. Fruit a drupe with hard 1-celled and 1-seeded endocarp.

Putranjiva Roxburghii, Wall. Vern. *Jūti*, R and H.—A small or medium-sized evergreen tree with dense crown of dark foliage and somewhat drooping branchlets attaining 6 feet girth and 60 feet high. Bark dark grey, often with pale patches, fairly smooth in general appearance but rough to the touch, split up by shallow cracks into numerous small hard corky pieces. Blaze .4—.7 inch, rather hard, shortly fibrous, pale yellow closely stippled in old stems with pale orange-brown, the whole darkening on exposure. Leaves 2—4 by 1—1.75 inches, elliptic-oblong, margin wavy and obscurely serrulate, glabrous, base oblique, dark glossy green above, pale with a fine network of darker nerves beneath; main lateral nerves indistinct. Petiole .15—.3 inch long. Flowers dioecious, small, axillary. Male flowers yellow, in heads or contracted racemes; pedicels very short. Female flowers green, solitary or 2-3 together; pedicels .3—.5 inch long. Drupe .6-.7 inch long, ellipsoid or subglobose, pale yellowish when ripe, containing a single hard stone pointed at both ends and surrounded by soft fleshy tissue.

Occurs in the Bhabar and subhimalayan tract up to 1,500 feet. It is found in moist and shady localities, but is not very common. Flowers: April-May. Fruit: February-March.

13. CYCLOSTEMON, Blume.

Trees. Leaves alternate, entire or crenulate, penninerved. Flowers inconspicuous, dioecious, apetalous, axillary, clustered or racemed in the male, or female solitary. Sepals 4—6, broad, imbricate, the two outer in the male covering the entire bud. Male flower with few to many stamens inserted round or on the disk; pistillode none or minute. Female flower, disk annular or none; ovary 2—4-celled; styles elongate or none, stigmas dilated, fleshy or connate in a peltate disk; ovules 2 in each cell. Fruit indehiscent with coriaceous or hardened pericarp.

Cyclostemon assamicus, Hook. f.—A small or medium-sized evergreen tree attaining 5 feet girth and 40 feet high. Bark fairly smooth, pale brown or ashy-white with a thin or corky exterior. Blaze .2-.3 inch, rather hard, shortly fibrous, pale yellow or whitish finely pencilled with orange. Twigs thickly lenticellate, hairy. Leaves 4—6.5 by 1.5—2.75 inches, ovate or elliptic-oblong, apex obtuse or subacute, base rounded or acute, and usually oblique, margin sinuate, upper surface glabrous and

dark glossy green, lower surface glossy, glabrescent except on the midrib which is sparsely covered with short adpressed hairs; lateral nerves indistinct 8—12 pairs. Petiole 2—4 inch long. Flowers axillary, subsessile, yellow, 25—35 inch diameter. Male flowers in clusters. Female flowers 1—4 together. Fruit 5—75 inch long, ovoid or elliptic-oblong, rusty-tomentose. Seeds 2.

There is only an incomplete specimen in the Dehra Dun herbarium from the Naudhaur valley east of Haldwani, and further proof of the occurrence of this tree within our area is wanted. It occurs in swampy places in the Dehra Dun between 1,000 and 2,500 feet. Flowers: November-December.

14. BISCHOFFIA, *Blume*.

A tree. Leaves alternate, trifoliate. Flowers small, dioecious, apetalous, in lateral paniced racemes. Sepals 5, orbicular, concave, imbricate, concealing the anthers in bud. Disk none. Male flowers; stamens 5; filaments short, inserted under the peltate pistillode. Female flowers; staminodes small or none; ovary 3-4-celled; styles long; ovules 2 in each cell. Fruit a 3-4-celled berry.

Bischoffia javanica, *Blume*. Vern. *Kæn*, Gen. *Kanji*, SG. *Pankæn*, H.—A large deciduous tree attaining 13 feet girth and 80 feet high. Bark rather dark reddish-brown, rough, exfoliating in soft short fibrous strips. Blaze 5—7 inch, soft, fibrous, pink streaked with blood-red towards the exterior. Petiole 2.5—6 inches long. Leaflets elliptic or elliptic-oblong, acuminate, crenate, glabrous, dark rather glossy green above, paler and glossy beneath; lateral nerves 6—8 pairs, inconspicuous. Terminal leaflet 5—7 by 2.25—4 inches. Stalk of terminal leaflets 1-2 inches long; petiolules of the lateral 2—4 inch long. Flowers greenish-yellow, in slender axillary or lateral paniculate racemes about as long as the petioles. Male flowers 1 inch diameter, rather crowded; pedicels 1 inch long. Female flowers 2 inch diameter, not crowded; pedicels rather longer than in the male. Berry compressed-globose, yellowish-brown, 3—5 inch diameter, containing several brown seeds embedded in a soft almost colourless pulp.

Occurs throughout the area up to 3,500 feet. It is fairly common along the banks of streams in the outer hill ranges, and is a typical species of swampy localities. The leaves usually turn pink before falling. Flowers: April-May. Fruit: December-January.

15. DAPHNIPHYLLUM, *Blume*.

Glabrous evergreen trees. Leaves alternate, entire, penninerved. Flowers dioecious, apetalous, in racemes, usually axillary. Male flowers; sepals 3—8, small, or calyx 4-toothed or discoid. Stamens 5—18; filaments short and free or 0. Pistillode 0. Female flowers: calyx of the male. Disk 0 or of 4—6 scales or glands. Ovary imperfectly 2-celled; styles or stigmas short, distinct, entire; ovules 2 in each cell. Fruit an oblong, usually 1-seeded drupe.

***Daphniphyllum himalayense*, Muell. Arg. Vern. Ratniāli, Gen.—**

A small or sometimes medium-sized evergreen tree attaining 6 feet girth and 70 feet high. Branches short, forming a conical crown. Bark smooth, pale ashy or grey, sometimes silvery in parts. Blaze .3-.4 inch, cheesy, pinkish or pale orange-brown speckled with darker orange-brown harder tissue in the outer portion. Leaves 5—11 by 1.7—3.25 inches, oblong, finely acuminate, base narrowed, glabrous and shining above, glaucous beneath; lateral nerves 10—14 pairs, slender. Petiole 1—3 inches long, pink with a swollen knee at its junction with the blade. Racemes 3-4 inches long, axillary or from below the leaves. Drupe .5—-.7 inch long, ellipsoid, usually slightly oblique, black with a thin bloom.

Occurs throughout the hills between 5,000 and 8,000 feet. It is found in moist shady forest and in deep ravines, but is local and never very common. Flowers: April-May. Fruit: November—March.

16. **ANTIDESMA**, Linn.

•Trees or shrubs. Leaves alternate, entire, stipulate. Flowers small, dioecious, apetalous, in slender sometimes paniced spikes or racemes. Calyx 3—5-rarely 7-lobed or -partite. Male flowers; stamens 2—5, rarely 6-7, inserted on or inside the lobed or annular disk, bases sometimes combined in a short column below the pistillode. Females: ovary usually 1-celled; stigmas 2—4, usually short, 2-lobed; ovules 2. Fruit a small drupe.

Leaves acute or acuminate. Flowers in glabrous usually simple racemes 1. *diandrum*.

Leaves rounded at the tip. Flowers in tomentose paniced racemes 2. *ghæsembilla*.

1. ***Antidesma diandrum*, Roth. Vern. Amli, G. Imli, R.—A** deciduous shrub 5—15 feet high with stems up to 6 inches diameter. Bark brown, fairly smooth, thinly mealy-corky. Blaze .2-.3 inch, cheesy, not fibrous, pink with or without whitish bands and tinged with chlorophyll outside. Leaves 2—6 by 1-2 inches, variable, the larger usually oblong-lanceolate, the smaller obovate or elliptic, usually acuminate, base acute, glabrous above, glabrous or slightly pubescent beneath, rather thick, nerves faint. Petiole .1-.2 inch long. Flowers minute, greenish, subsessile, in slender terminal racemes 1-2.5 inches long; racemes simple or with a few branches. Stamens usually 2. Drupe ovoid, .2-.25 inch long, succulent, turning first red and finally black.

Occurs throughout the area up to 5,000 feet. Fairly common in sal and miscellaneous forests of the subhimalayan tract and outer hill ranges. The leaves are acid. They turn pink or dull red some time before falling, so that brightly coloured leaves may be seen from December to March. Flowers: May-June. Fruit: December-January.

2. *Antidesma ghæsembilla*, *Gærtn.*—A deciduous shrub or small tree. Bark pale, smooth or slightly cracked. Blaze pink. Leaves 2—4·5 inches long, oval obovate or orbicular-oblong, rounded or emarginate at the apex, sometimes also with a short blunt acumen, glabrous or nearly so above, pubescent or tomentose beneath; base rounded or subcordate; main lateral nerves 3—6 pairs. Petiole 2—5 inch long. Flowers greenish-yellow, small, subsessile, in densely tomentose paniced racemes 1-2 inches long. Stamens 4—7. Drupe subglobose, 2 inch diameter, reddish or black when ripe.

This species has only been collected from the Ramnagar Division where it appears to be rare. Its distribution extends eastwards to Bihar and Orissa and it is likely to be found in dry localities up to 2,000 feet. Flowers: May-June.

17. *JATROPHA*, *Linn.*

Herbs shrubs or trees. Leaves alternate, palmately-nerved, entire lobed or partite, stipulate. Flowers in terminal cymes, monœcious, the central one in the cyme or its forks usually female. Sepals 5, imbricate. Petals 5, free or connate. Disk entire or of 5 glands. Stamens usually 10; filaments, or the inner ones only, connate. Pistillode in male none. Ovary 2—4-celled; styles connate below, 2-fid; ovules 1 in each cell. Fruit of 2—4 two-valved cocci, endocarp crustaceous or bony.

Jatropha Curcas, *Linn.*—A deciduous shrub or sometimes a small tree with stems up to 9 inches diameter and 15 feet high. Twigs stout. Bark of branches pale greenish- or yellowish-brown, smooth, exfoliating in thin papery rolls with small scattered circular lenticels, becoming pale brown and rough on mature stems. Blaze 1—3 inch, somewhat fibrous, white exuding a clear pink sticky juice on immature stems, becoming pale brown on mature stems. Leaves variable in size, 4—10 by 3—9 inches, broadly ovate, cordate, acute, usually palmately 3- or 5-lobed, glabrous, base 7-nerved. Petiole 3—12 inches long, terete. Flowers 3 inch across, yellowish-green, in lax axillary cymose panicles 2—5 inches long. Fruit 9—1 inch long, dull dark brown or blackish, ovoid-oblong, breaking up into 3 two-valved cocci. Seeds 3, oblong, dull dark brown, 7 inch long.

Indigenous to America, but cultivated as a hedge plant throughout our area up to 4,000 feet. It is also found self-sown and apparently wild in some of the dry miscellaneous areas of the Bhabar. It flowers in the hot weather and rains and the fruit ripens during the cold weather.

18. *TREWIA*, *Linn.*

Trees. Leaves opposite, cordate, entire, palminerved. Flowers dicecious, apetalous and without a disk. Males in drooping catkin-like racemes; calyx globose; sepals 3-4, concave; stamens many, central, free. Female flower larger, solitary, on a long peduncle or racemose;

sepals 3—5, broad, imbricate; ovary 2—5-celled; styles 2—5, connate below, very long, entire; ovules solitary in each cell. Fruit drupaceous with a 2—5-celled crustaceous endocarp, rarely opening loculicidally.

Trewia nudiflora, Linn. Vern. *Gutel*, H.—A medium-sized deciduous tree attaining 10 feet girth and 80 feet high. The trunks of old trees more or less fluted at the base. The lower branches often pendent. Bark smooth, pale yellowish-brown or sometimes grey, exfoliating in irregular thin plates. Blaze 3—5 inch, cheesy, not fibrous, pale yellow sometimes with a few pale orange streaks. Leaves 6—9 by 4·5—7 inches, ovate, acuminate, base usually cordate, 3- or 5-nerved, glabrous when mature, glandular at the base near the top of the petiole. Petiole 2—4 inches long. Male flowers yellow, 3 inch diameter, arranged in fascicles on the rachis of a lax drooping raceme 4—9 inches long; racemes appearing before the leaves. Female flowers green, solitary or 2-3 together on axillary peduncles about 1 inch long. Fruit depressed-globose, 1·2 inches diameter, greenish-brown with minute pale dots, the consistency of an apple, containing 4 smooth hard black seeds 3·4 inch long.

Occurs in the subhimalayan and Bhabar tracts up to 2,000 feet. Common in moist and swampy localities bordering streams. The leaves turn yellow in the cold weather before falling. Flowers: February—April. Fruit: November–December.

19. MALLOTUS, Lour.

Trees or shrubs. Leaves opposite or alternate, entire, toothed or lobed, often gland-dotted beneath. Flowers small, usually dioecious, apetalous; males clustered and females solitary in the bracts of simple or paniced spikes or racemes. Male flowers: calyx valvately 3—5-partite; stamens numerous, central, free; anthers 2-celled, the cells adnate to and often widely separated by the thickened connective. Female flowers: calyx spathaceous or valvately 3—6-lobed or -partite; ovary 2—4-celled; styles free or connate at the base, entire; ovules solitary in each cell. Fruit a capsule of 2-3 two-valved cocci.

Mallotus philippinensis, Muell. Vern. *Ruina*, G. Roli, EA, H. and R.—A small evergreen tree attaining 6 feet girth and 45 feet high. Stems often deeply fluted. Bark slightly rough, pale or dark brown often with silvery patches exfoliating in small hard irregular woody scales. Blaze 3·4 inch, rather coarsely fibrous, bright pinkish- or purplish-brown sometimes streaked with white. Leaves simple, alternate, very variable, usually 3—6 by 2-3 inches, ovate ovate-oblong or lanceolate, acuminate, entire or serrulate, glabrous above, minutely pubescent and closely dotted with minute red glands beneath, distinctly reticulate, base usually rounded, 3-nerved. Petiole 1—3 inches long.

Flowers .15 inch across, yellowish, dioecious. Male flowers in terminal clustered erect spike-like racemes 4—10 inches long, occasionally a few solitary racemes in the axils of the upper leaves. Female flowers in terminal or axillary spikes 1—4 inches long. Fruit a 3-lobed capsule .3—·5 inch diameter, covered with a red resinous powder. Seeds black. globose, .15—·2 inch diameter.

Occurs throughout the area up to 5,500 feet. Abundant and often gregarious in dry miscellaneous, moist miscellaneous and *sal* forest. Flowers: September—November. Fruit: March—May.

20. MACARANGA, *Thouars*.

Trees or shrubs with most of the characters of *Mallotus*. Leaves usually peltate, often large. Female flowers one to few in a bract; calyx 2—4-lobed or -toothed; ovary 1—6-celled. Males: stamens 1-many; anthers usually 4-celled. Fruit a capsule with 1—6 cocci.

Leaves peltate	...	...	...	1. <i>indica</i> .
Leaves not peltate	...	...	...	2. <i>pustulata</i> .

1. **Macaranga indica**, *Wight*.—A medium-sized tree up to 6 feet girth. Bark smooth, grey. Young shoots glabrous, glaucous. Leaves alternate, 6—12 by 5—10 inches, orbicular-ovate, acuminate, base rounded, margin entire or obscurely denticulate, peltate, densely hirsute on both surfaces when quite young, soon becoming glabrous or nearly so on both surfaces except along the nerves beneath, lower surface between the nerves densely covered with small yellow glands, basal nerves 3 principal with 5—7 smaller below, secondary nerves 7—10 pairs curved within the margin and giving off short nervules which terminate in marginal glands. Petiole 4—12 inches long, glabrous, glaucous. Stipules .5 inch long, ovate, acuminate, glabrous, caducous. Flowers small. dioecious, in axillary tomentose panicles, the female 2-3 inches long, the male 3-4 inches long. Pedicels of female flowers .2—·4 inch long. Stamens 6—10. Capsule of 1 coccus, .15—·2 inch diameter, globose. Seed 1, globose.

Occurs on the outer hill ranges between 3,000 and 4,000 feet. Scarce. Flowers: August-September. Fruit: November-December.

2. **Macaranga pustulata**, *King*.—A small or medium-sized tree up to 5 feet girth. Young shoots clothed with short rusty tomentum. Leaves alternate, 4—9 by 3·5—8 inches, sometimes broader than long, orbicular-ovate, acuminate, base truncate, rusty-tomentose on both surfaces when quite young especially on the nerves beneath, ultimately glabrescent on both surfaces with more or less tomentum remaining on the nerves beneath, lower surface between the nerves densely covered with small yellow glands, with two large glands on the upper surface near its junction with the petiole, base 3—5-nerved with 5—11 pairs of

secondary nerves above the basal, margin entire or sometimes obscurely dentate. Petiole 2—6 inches long, tomentose at first, soon becoming glabrous. Stipules .3 inch long, triangular, acute, caducous. Flowers small, in branched axillary tomentose panicles 1-2 inches long. Capsules oblong, .3 inch on the long diameter, grooved between the two cocci. Seeds 2, globose, nearly black.

Occurs in the East Almora Division between 2,000 and 5,000 feet where it is rare except in the north-eastern portion of the division. It has not been recorded further west. Fruit : July.

21. RICINUS, *Linn.*

A tall herb shrub or small tree. Leaves large, palmately-lobed. Flowers in terminal subpanicled racemes, monœcious, apetalous and without a disk. Males crowded in the upper parts of the racemes ; calyx splitting into 3—5 valvate segments ; stamens numerous, connate in several branched columns. Female flowers large, in the lower part of the raceme ; calyx spathaceous, caducous ; ovary 3-celled ; styles spreading, entire 2-fid or 2-partite ; ovules solitary in each cell. Fruit a prickly capsule of 3 two-valved cocci.

***Ricinus communis*, Linn.** Vern. *Arandi* or *Andi*, Gen. In, A. Eng. Castor oil.—An evergreen shrub or small tree up to 20 feet high and six inches diameter. Bark pale greenish-brown, smooth, lenticellate. Leaves alternate, 9—18 inches long and broad, 7-many-lobed, palmate, peltate, lobes acuminate, serrate, teeth irregular and blunt. Petiole stout, about as long as the blade. Fruit an echinate capsule .8 inch long excluding the soft spines, breaking up into 3 two-valved crustaceous cocci. Seeds oblong, smooth, mottled.

This species, probably of African origin, is completely naturalised in India, and occurs either under cultivation or run wild throughout the area of this flora up to 5,000 feet. There are several varieties. It flowers at various seasons.

22. BALIOSPERMUM, *Blume.*

Shrubs. Leaves alternate, sinuate toothed or lobed, base with 2 glands. Flowers small, monœcious or dioecious, apetalous, in fascicles racemes or panicles. Male flowers : sepals 4—6, concave, imbricate ; disk of 4—6 glands ; stamens 10—30 ; filaments all or mostly free. Female flowers : sepals 5-6, sometimes accrescent in fruit ; disk entire ; ovary 3-celled ; styles 2-fid or 2-partite ; ovules solitary in each cell. Fruit a capsule of 3 two-valved cocci.

***Baliospermum montana*, Muell.** Syn. *B. axillare*, Blume.—A small subdeciduous shrub with erect annual or perennial stems which attain 6 feet high and .75 inch diameter when supported amongst surrounding vegetation. Bark fairly smooth, pale brown. Leaves very

variable in size and shape, usually 4—6 inches long, irregularly and coarsely toothed, sometimes palmately 3—5-lobed, base rounded or subcordate and 3—5-nerved, glabrous or with large scattered hairs, upper surface dark green and slightly glossy with prominent raised nerves. Petiole very variable, up to 9 inches long. Flowers minute, greenish, monœcious, in lax interrupted axillary racemes, usually very short but sometimes 2 inches long. Capsule 3-lobed, .3-.4 inch long, pubescent or glabrous. Seeds .3-.4 inch long, smooth, mottled.

Occurs throughout the area between 1,000 and 3,500 feet. Fairly common in some localities and found equally in dry or moist situations. Tends to grow gregariously in small patches. Flowers almost throughout the year.

23. SAPIUM, *P. Br.*

Trees or shrubs with milky juice. Leaves alternate, entire or toothed; petiole often 2-glandular at the top. Flowers in terminal spikes or racemes, monœcious or dioecious, apetalous and without a disk. Males several in each bract; calyx shortly 2-3-lobed or valvately 3-sepalous; stamens 2-3, free. Female flowers usually at the base of the spikes, solitary in each bract, or spikes unisexual; calyx 3-fid or partite; ovary 2-3-celled; styles sometimes connate at the base, spreading, simple; ovules solitary in each cell. Fruit a crustaceous fleshy or rarely woody capsule, at length loculicidally 3-valved.

I.—Leaves less than 5 inches long. Spikes androgynous, appearing after the leaves.

- | | | | |
|--|-----|-----|----------------------------|
| 1. Leaves rhomboid. Bark rough | ... | ... | 1. <i>sebiferum</i> . |
| 2. Leaves ovate or elliptic. Bark smooth | ... | ... | 2. <i>eugeniaefolium</i> . |

II.—Leaves more than 5 inches long. Spikes unisexual, appearing before the leaves

...	...	3. <i>insigne</i> .
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1. *Sapium sebiferum*, *Roxb.* Eng. Chinese Tallow-tree.—A small or medium-sized deciduous tree attaining 6 feet girth and 60 feet high. Bark pale brown or grey, rough with shallow vertical cracks, exfoliating in small strips or irregular pieces. Blaze .3—5 inch, pale yellow finely mottled with pale orange. Leaves 1.5—3 inches long and broad, rhomboid, acuminate, entire, glabrous, pale or somewhat glaucous beneath. Petiole 1-2 inches long, slender. Flowers yellow, monœcious, in drooping terminal spike-like racemes 2—8 inches long, usually solitary at the ends of the leafy shoots, male flowers above, female below. Capsule subglobose, .4—6 inch diameter, the valves ultimately breaking away and leaving the seeds attached to the apex of a central column which splits into 3 slender divisions. Seeds enclosed in a thick layer of white fatty substance.

Indigenous to China and Japan but not uncommonly planted along roadsides up to 5,000 feet. Occasionally self sown under favourable conditions. The foliage somewhat resembles that of the *sisso*. Before falling the leaves become beautifully tinted with orange and scarlet. Flowers: June—August. Fruit: December.

2. *Sapium eugeniaefolium*, Ham.—A small tree up to 40 feet high and 6 feet girth. Bark pale grey, nearly smooth. Young shoots covered with a waxy glaucous bloom, glabrous. Leaves 2·5—3·5 by 1·25—1·75 inches, ovate or elliptic, acute or subacute, base rounded, entire, glabrous, often glaucous beneath; lateral nerves slender 6—8 pairs. Petiole ·8—1·5 inches long, slender, with two glands at or near the top. Flowers small, in simple terminal spike-like racemes 3—4 inches long. Capsule subglobose, ·4·5 inch diameter, woody. Seeds globose.

This species is found in the Ramganga valley in east Almora between 3,000 and 4,000 feet, but has not been collected elsewhere within our area. Its range extends eastwards. Mr. R. N. Parker found it growing near Thal in company with *S. sebiferum* and he affirms that the two are hybridizing in this locality. Fruit: June-July.

3. *Sapium insigne*, Trim. Vern. *Khinna*, G. *Khin*, A.—A small or medium-sized deciduous tree attaining 7 feet girth and 30 feet high. Bark rough, divided by deep wide furrows into thick corky ridges, pale brown or sometimes dark grey varied with whitish patches. Blaze ·8—1·5 inches, yellowish-white, fibrous, exuding a copious milky juice. Twigs stout. Leaves 8—16 by 2·5—5 inches, crowded towards the ends of the branches, elliptic-oblong or lanceolate-oblong, acute or acuminate, crenate-serrate, glabrous, glossy on both surfaces, base acute or narrowed, lateral nerves 10—20 pairs. Petiole 1—2·5 inches long, with two conspicuous green glands at the apex. Flowers appearing before the leaves, yellowish-green, dioecious, in stout erect spikes 3—9 inches long. Capsule ovoid, ·3 inch long, fleshy at first, dry and irregularly dehiscent when ripe.

Occurs throughout the area between 1,000 and 5,500 feet. Common in open miscellaneous forest and thrives amongst loose rocks or on steep rocky ground. In immature leaves the petiole and midrib above are pink or red. Flowers: February-March.

24. EXCÆCARIA, Linn.

Glabrous trees or shrubs with acrid milky juice. Leaves alternate or opposite. Flowers in bracteate spikes or racemes, monoecious or dioecious, small, apetalous, the rachis with large glands. Male flowers 1—3 in each bract; sepals 3—5; stamens 3, free with didymous anthers. Female flowers sometimes on the lower part of the male spikes, sometimes on distinct racemes or spikes; calyx 3-fid or-partite; ovary 3-celled; styles 3, spreading or recurved; ovules solitary in each cell. Fruit a capsule of 3 cocci separating from a columella.

Excœcaria acerifolia, F. Didrichs. Vern. *Dūdihila*, NG.—An erect deciduous shrub 3—6 feet high with stems up to ·8 inch diameter. Bark fairly smooth with scattered small pale circular lenticels. Blaze with a milky juice. Young shoots glabrous. Leaves alternate, 3—5 by

1·25—2 inches, narrowly elliptic or oblong, acuminate, finely crenate-serrate, base usually acute, glabrous, rather glossy above; lateral nerves 8—12 pairs. Petiole ·15—·3 inch long. Flowers small, greenish-yellow, in terminal and axillary spikes 1-2 inches long, the female flowers towards the base of the spike. Capsule subglobose, about ·5 inch diameter, coriaceous, 3-valved, the valves twisting elastically as they break away. Seeds ovoid, ·2 inch long, smooth.

Occurs along the valleys of the inner and main Himalayan ranges between 4,000 and 7,500 feet. It is very common and gregarious on open stony ground in the vicinity of cultivation along the Alakhnanda valley above Chamoli. Flowers: April-May and again July-August. Fruit: July and December.

LXXX.—ULMACEÆ.

Trees, more rarely shrubs. Leaves simple, often unequal-sided. Stipules lateral or intrapetiolar. Flowers mostly small, in axillary clusters or cymes, or females sometimes solitary, rarely all bisexual, usually polygamous, monoecious or dioecious. Perianth usually 4-5-merous, polyphyllous or gamophyllous. Stamens isomerous to and opposite to the perianth-lobes, rarely twice as many (*Holoptelea*), anthers erect in bud, dehiscence lateral. Pistillode usually present in male. Ovary of 2 median carpels, rarely 2-celled; stigmas 2 large, or style 2-fid or 4-fid; ovule solitary. Fruit indehiscent, a nut drupe or samara.

I.—Fruit winged. Leaves not 3-nerved from the base.

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|-------------------|-----|-----|-----|------------------------|
| 1. Leaves serrate | ... | ... | ... | 1. <i>Ulmus</i> . |
| 2. Leaves entire | ... | ... | ... | 2. <i>Holoptelea</i> . |

II.—Fruit not winged. Leaves 3-nerved from the base.

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|--|-----|-----|--------------------|
| 1. Leaves smooth, not scabrid | ... | ... | 3. <i>Celtis</i> . |
| 2. Leaves scabrid, at least on the upper surface | ... | ... | 4. <i>Trema</i> . |

1. *ULMUS*, *Linn.* (*The Elms*.)

Deciduous trees. Leaves alternate, distichous, serrate, penninerved; stipules lateral, scarious, variable in size. Flowers bisexual or mostly male, in clusters from the leaf-scars. Perianth campanulate, 4—8—usually 5-lobed, imbricate. Stamens as many as the perianth-lobes. Ovary compressed; style shortly 2-fid or 2-partite. Fruit a nut winged all round, wing obliquely orbicular, reticulate.

I.—Leaves 3—6 inches long, scabrid above. Pedicels

1—2 inch long. Ovary pubescent ... 1. *Wallichiana*.

II.—Leaves 2—4·5 inches long, usually smooth above.

Pedicels less than ·05 inch long. Ovary glabrous 2. *Brandisiana*.

1. *Ulmus Wallichiana*, *Planch.* Vern. *Mai*, *Mairu* or *Chamar-mowa*, G.—A large deciduous tree up to 9 feet girth and 110 feet high. Twigs more or less pubescent when young. Bark dark brown, rough with rather deep and regular vertical fissures. Blaze 5—75 inch, very fibrous, pink rapidly turning orange-brown on exposure with a soapy juice. Leaves 3—6 inches long, elliptic elliptic-oblong or obovate, acuminate, doubly serrate, scabrid above, pubescent or glabrate beneath, base usually very oblique and slightly cordate or not; main lateral nerves straight prominent 10—20 pairs. Petiole 2—4 inch long, pubescent. Flowers in congested racemes 4·5 inch across. Pedicels 1·2 inch long, jointed, lengthening in fruit so that the perianth-lobes are much less than half length of perianth-tube plus portion of pedicel above the joint. Perianth 12 inch long, 5-6-lobed, glabrous except for a few,

long ciliate hairs. Ovary slightly hairy. Filaments glabrous anthers exerted. Ripe samara 4—6 inch diameter, orbicular, glabrous or thinly puberulous.

Probably occurs throughout the hills between 5,000 and 9,500 feet, but this and the next species have often been confused and their limits have not been accurately determined. It is a common species in mixed deciduous forests of horse-chestnut, walnut, etc. and in silver fir forests along the main Himalayan range. I have measured a tree in North Garhwal 13·5 feet girth and 100 feet high. Flowers: March-April whilst leafless. Fruit: June.

2. *Ulmus Brandisiana*, Schn. Vern. Same as for last species.—A small or large deciduous tree up to 9 feet girth and 100 feet high. Twigs minutely hairy, lenticellate. Bark pale brown, rough, with rather deep and regular vertical furrows. Blaze 75—1·5 inches, soft, very fibrous, pink rapidly turning orange-brown on exposure with a sticky and slimy juice. Leaves 2—4·5 by 75—2 inches, oblong-lanceolate or elliptic-lanceolate, acuminate, doubly serrate, base more or less unevenly cordate, glabrous or puberulous when young and smooth and glabrous when mature above, glabrous beneath except for tufts of hairs in the nerve-axils; main lateral nerves straight prominent 10—20 pairs. Petiole 2—5 inch long, hairy, terete. Flowers in congested racemes 2·3 inch across. Pedicels about 03 inch long, jointed not lengthening in fruit so that the perianth-lobes are more than half length of perianth-tube plus portion of pedicel above the joint. Perianth 12 inch long, 4-5-lobed, glabrous except for a few long ciliate hairs. Bracts spatulate, about equalling the perianth, glabrous except for long ciliate hairs. Style 2-partite, inner faces villous. Ovary glabrous. Filaments glabrous, anthers exerted. Ripe samara 3—4 inch diameter, orbicular, glabrous on both sides.

This species was only described by Schneider in 1916 and has not hitherto been recognised from our area, though many collectors have regarded as certain the existence of another species besides *U. Wallichiana*. I am indebted to Dr. Augustus Henry who kindly identified specimens of this species for me. It appears to be found throughout the hills between 4,500 and 7,000 feet. Flowers: February whilst leafless.

2. *HOLOPTELEA*, *Planch.*

A tree. Leaves alternate, penninerved; stipules scarious, caducous. Flowers fascicled on the leaf-scars of previous years' shoots and appearing before the new leaves. Perianth campanulate, cleft to the base, with 4—8 imbricate lobes. Stamens 4—8, in two whorls; filaments at length exerted. Ovary stipitate, compressed; style short, 2-fid. Fruit a samara.

Holoptelea integrifolia*, *Planch. Vern. *Pāpri*, SG, R and L. *Kānju*, A and H.—A large deciduous tree up to 14 feet girth and 110 feet high. Bark of stems up to middle age smooth, silvery-grey with blackish patches and numerous minute reddish lenticels, ultimately rough, exfoliating in irregular somewhat corky scales. Blaze 5—9

inch, not or shortly fibrous, pale yellow with a few orange streaks or uniformly orange-brown. Young shoots pubescent. Leaves 2—4 by 1·5—2·5 inches, elliptic, acuminate, entire (or in young trees toothed), base rounded or subcordate, glabrous above, often pubescent beneath when young; lateral nerves 5—8 pairs. Petiole 2—4 inch long. Flowers green, bisexual or male, in very numerous fascicles or short racemes on leafless branches at the leaf-scars. Perianth of 4—8 lobes about 1 inch long. Samara 75—1 inch diameter, suborbicular on a slender stipe 1·2 inch long and jointed pedicel 2·3 inch long; wing membranous.

Occurs along the subhimalayan tract and outer hill ranges up to 2,500 feet. Very common in dry miscellaneous Bhabar forests on boulder formations bordering rivers, and in such localities is somewhat gregarious. Old stems are buttressed at the base. Bruised leaves or the cut bark emit a strong smell of fresh walnuts. Flowers: February-March. Fruit: April-May.

3. *CELTIS*, Linn.

Trees or shrubs. Leaves alternate, usually oblique and 3-nerved. Flowers small, cymose, polygamous, male and bisexual cymes usually at the base of the shoots; female in the upper axils, often solitary. Perianth-segments 4-5, imbricate. Stamens 4-5, inserted round a rudimentary ovary which is surrounded by a hairy disk. Ovary sessile, on a hairy disk; style with stout plumose simple or lobed arms. Fruit a drupe with smooth or rugose endocarp.

I.—Ovary and young drupes seated on a hairy disk, pilose towards the stigmas, otherwise glabrous. Leaves thin.

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|--|-----|-----------------------|
| 1. Leaves coarsely serrate almost to the base. | | |
| Drupe purplish-black | ... | 1. <i>australis</i> . |
| 2. Leaves sub-entire or serrated above the middle. | | |
| Drupe orange-red | ... | 2. <i>tetrandra</i> . |

II.—Ovary and young drupes densely tomentose. Leaves thick. Drupe yellowish

...	...	3. <i>eriocarpa</i> .
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1. *Celtis australis*, Linn. Syn. *C. alpina*, Royle. Vern. Kharik.

G. Khark, A.—A large deciduous tree up to 7 feet girth and 100 feet high. Bark pale ashy or grey, smooth with numerous small circular lenticels and occasional horizontal wrinkles, exfoliating in irregular woody pieces. Blaze 25—75 inch, very hard, yellow, thickly mottled and streaked with purplish-brown. Young shoots pubescent. Leaves 3—6 by 1·5—3 inches, ovate or elliptic, caudate-acuminate, base rounded and unequal, coarsely serrate from near the base to the tip, thin, dull green above, glaucescent beneath, glabrous except for a few hairs on the midrib beneath and tufts of hairs in the nerve-axils, main lateral nerves 3-4 pairs including the basal pair. Petiole 3—5 inch long, channelled. Flowers small, greenish. Perianth-segments ovate, fringed with woolly hairs. Ovary glabrous except in the upper portion where it is narrowed

into a short hairy style. Drupe .4-.5 inch long, ellipsoid, purplish black; peduncle 1—1.4 inches long.

Occurs along the main Himalayan range between 5,500 and 9,000 feet. Common in mixed deciduous forests and stands shade well. Flowers: April-May. Fruit: September-October.

2. *Celtis tetrandra*, Roxb. Vern. *Kharik*, Gen.—A large deciduous tree up to 14 feet girth and 70 feet high. Bark pale ashy or grey, quite smooth, closely lenticellate, usually with narrow horizontal wrinkles, exfoliating in thick woody pieces. Blaze .4—.9 inch, very hard, pale yellow densely mottled with dark purplish- or reddish-brown, often tinged with chlorophyll outside. Young shoots glabrous or tomentose. Leaves 2.5—5 by 1-2.5 inches, ovate or elliptic-ovate, acuminate and often caudate, base rounded or acute and unequal, more or less serrate from the middle to the base of the caudate apex, pubescent when young, glabrous above and glabrous or hairy on the nerves beneath when mature, thin, main lateral nerves 2—4 pairs including the basal. Petiole .2—.5 inch long, channelled. Flowers small, greenish. Perianth-segments elliptic, fringed and woolly on the margin. Ovary pilose at the apex. Style 0. Drupe .3 inch long, globose, orange-red when ripe; peduncle .5—.7 inch long.

Occurs in the subhimalayan tract and in the central and outer hill ranges between 1,000 and 6,000 feet. Frequently cultivated in the hills and perhaps not wild as high as 6,000 feet. Flowers: February-March. Fruit: September-October.

3. *Celtis ericarpa*, Decne. Vern. *Kharik* or *Kharish*, NG.—A small or medium-sized deciduous tree. Bark smooth, pale grey. Blaze .3-.4 inch, dry, crisp, yellow closely mottled with orange and purple towards the interior. Young shoots pubescent or tomentose. Leaves 2—4 by 1-2 inches, ovate or lanceolate, caudate-acuminate, base rounded or obtuse and unequal, subentire or serrate from the middle to the base of the caudate apex, rather thick and coriaceous, glossy dark green above, pubescent on both surfaces when young, glabrous or nearly so when mature, main lateral nerves 1—3 pairs including the strong basal pair. Petiole .2—.4 inch long. Flowers small, greenish. Perianth-segments elliptic-ovate, silky outside, woolly within. Ovary densely tomentose. Style 0. Drupe .3 inch long, yellowish, densely tomentose when young, ultimately more or less glabrous; peduncle .5—1 inch long.

Occurs throughout the hills between 3,000 and 6,000 feet. Generally in open types of forest, often on south aspects. Flowers: March-April. Fruit: September—November.

4. TREMA, Lour.

Shrubs or trees. Leaves alternate, 3—7-nerved at the base, often oblique; stipules lateral, caducous. Flowers small, monoecious, dioecious or polygamous in axillary cymes. Perianth-segments 4-5, induplicate-valvate or subimbricate. Stamens 4-5. Pistillode in male small or

none. Style in hermaphrodite or female 2-fid or stigmas 2. Fruit a small drupe seated on the persistent perianth, endocarp hard.

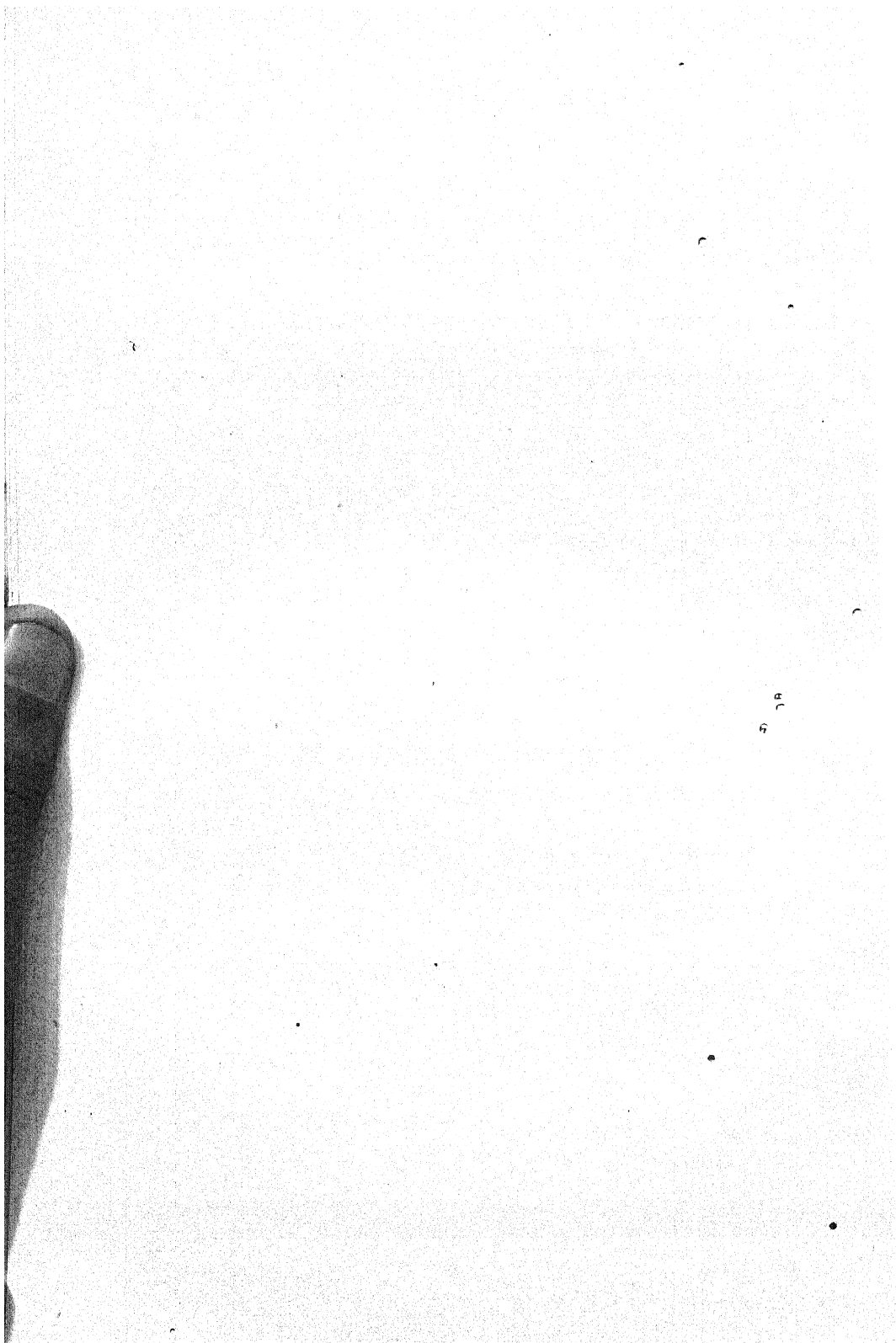
Leaves scabrid on both surfaces. Male cymes compact,
not longer than the petiole ... 1. *politoria*.
Leaves more or less scabrid above, softly tomentose
beneath. Cymes spreading, longer than the
petiole ... 2. *orientalis*.

1. *Trema politoria*, Planch. Vern. *Jhau*, Gen.—An evergreen shrub or small tree up to 3 feet girth and 30 feet high. Bark pale brown, somewhat tubercular with numerous small lenticels. Blaze .3—·5 inch, very fibrous, pinkish turning reddish-brown on exposure. Twigs scabrid. Leaves 2—5 by .8—1·5 inches, oblong or ovate-lanceolate, acuminate, serrulate, base rounded or subcordate, subcoriaceous, very rough and scabrid on both surfaces, dark glossy green above, base 3- or obscurely 5-nerved. Petiole .2—·4 inch long. Flowers small, greenish; cymes of male flowers as long as or shorter than the petiole. Male flowers .2 inch diameter; perianth-segments with woolly margins. Female flowers rather smaller. Ovary glabrous, exserted, on a woolly torus. Drupe .1 inch long, ovoid, black, glabrous.

Occurs throughout the area between 1,000 and 5,000 feet. Common, usually in open exposed positions, often on road cuttings and any newly-formed soil. Flowers: April—June. Fruit: December—January.

2. *Trema orientalis*, Blume.—A small evergreen tree up to 2 feet girth and 30 feet high. Bark pale ashy or pale grey, smooth, with numerous minute raised lenticels often arranged in transverse bars. Blaze .25 inch, fibrous, pinkish, rapidly turning orange on exposure. Twigs pubescent. Leaves 3—7 by 1·2·5 inches, ovate or ovate-lanceolate, caudate-acuminate, more or less scabrid above, white- or silky-tomentose beneath; base 3—5-nerved, often cordate. Petiole .2—·5 inch long. Cymes lax, spreading, longer than the petioles. Otherwise as for *T. politoria*.

Occurs throughout the hills between 2,000 and 4,500 feet. Rather scarce. Sometimes cultivated round villages for its fodder. Flowers: May-June.



LXXXI.—URTICACEÆ.

Herbs or shrubs, rarely trees, sometimes furnished with stinging hairs, sap watery. Leaves opposite or alternate, base usually 3-nerved; stipules usually membranous. Flowers small, monœcious or diœcious, in open or capitate cymes or cymules, axillary or at the axils of fallen leaves, or lateral to and at the base of axillary shoots, leafless and spiciform. Perianth 4-5—seldom 2-3-merous, segments free or united. Stamens in males as many as the perianth-segments and opposite them; filaments usually flat at the base. Pistillode usually present. Female flowers with usually gamophyllous perianth sometimes accrescent and fleshy in fruit; ovary superior, 1-celled; style simple or none; ovule solitary. Fruit a drupel or utricle, usually enclosed in and often united to the perianth.

- I.—Flower-clusters arranged in spikes ... 1. *Bœhmeria*.
- II.—Flower-clusters arranged in dichotomous cymes or panicles .5 inch long or more.
 - 1. Whole plant clothed with stinging hairs ... 2. *Urtica*.
 - 2. Not clothed with stinging hairs ... 3. *Maoutia*.
- III.—Flower-clusters sessile or in cymes less than .5 inch long.
 - 1. Fruit dry ... 4. *Pouzolzia*.
 - 2. Fruit succulent.
 - (a) Leaves ovate or elliptic, green beneath ... 5. *Villebrunea*.
 - (b) Leaves oblong-lanceolate, white beneath ... 6. *Debregeasia*.

1. *Bœhmeria*, Jacq.

Shrubs or small trees. Leaves opposite or alternate, toothed, 3-nerved at the base; stipules usually free. Flowers monœcious or diœcious, in unisexual clusters arranged in axillary or paniced spikes or racemes, or clusters axillary. Male perianth 3—5-lobed or -partite. Stamens 3—5. Pistillode clavate or globose. Female perianth tubular, 2—4-toothed, sometimes angled winged or swollen in fruit. Stigma filiform. Fruit a crustaceous achene closely invested by the perianth, at length free.

- I.—Width of leaves much less than half their length.
 - 1. Leaves alternate, 3—6 inches long ... 1. *rugulosa*.
 - 2. Leaves opposite, 6—12 inches long ... 2. *macrophylla*.
- II.—Width of leaves much greater than half their length.
 - 1. Leaves orbicular, softly tomentose on both surfaces ... 3. *platyphylla*.
 - 2. Leaves ovate, scabrid on both surfaces ... 4. *scabrella*.

1. *Bœhmeria rugulosa*, Wedd. Vern. *Ghenti*, Gen.—A small evergreen tree up to 3 feet girth and 15 feet high. Bark dark brown, rough and deeply furrowed. Blaze 1 inch, soft, somewhat fibrous, pink, with a viscid slimy juice. Leaves alternate, 3—6 by 1-2 inches, elliptic-oblong or lanceolate, acute or acuminate, crenate or bluntly serrate, glabrous and dark green above, pale and velvety beneath, longitudinally 3-nerved almost to the tip, the 3 nerves penninerved, the lateral veins of the midrib anastomosing with those of the two side nerves, the lateral veins on the outside of the side nerves joined by an intramarginal vein. Petiole .5—1.5 inches long. Stipules connate between the petiole and the stem. Flowers diœcious, in clusters, each cluster in the axil of a cordate bract, the clusters arranged in simple axillary spikes 2—6 inches long. Achene less than .1 inch long, ciliate towards the top.

Occurs throughout the hills between 1,500 and 5,500 feet. Very common in dry miscellaneous forests of the outer ranges. Sometimes cultivated for its fodder. Flowers: July—September.

2. *Bœhmeria macrophylla*, Don.—A shrub or small tree. Twigs obtusely 4-angled, usually strigose. Leaves opposite, 6—12 by 1-2 inches, lanceolate, gradually tapering to a long acuminate point, closely serrulate, glabrous or sparsely hispid above, pubescent beneath, upper surface rugose with greatly depressed reticulate nerves, longitudinally 3-nerved the two side nerves reaching from half to two-thirds the length of the blade, the lateral veins as described for *B. rugulosa* but the midrib with obliquely ascending lateral nerves in the upper half of the blade. Petiole .2—1.5 inches long. Flowers monœcious (?) in dense rounded clusters, the clusters arranged in axillary drooping spikes 5—10 inches long, simple or sometimes branched below.

Occurs in ravines between 1,000 and 1,500 feet elevation in the outermost ranges of the Himalaya towards the extreme east of the Haldwani Division. Flowers: August-September.

3. *Bœhmeria platyphylla*, Don. Vern. *Khāgsi*, G.—An erect deciduous shrub 2—8 feet high with stems up to 1.5 inches diameter. Bark slightly rough owing to numerous small raised lenticels. Leaves opposite, 4—10 by 3.5—9 inches, orbicular or suborbicular, apex abruptly terminating in a narrow caudate acumen, coarsely serrate, base rounded, softly pubescent on both surfaces, membranous, base strongly 3-nerved, the midrib with 2-3 pairs of lateral nerves above the basal. Petiole 1—8 inches long. Flowers diœcious or monœcious, in clusters, the clusters arranged in axillary somewhat drooping spikes. Male spikes 2—5 inches long, sometimes forming dense axillary fascicles, often branching. Female spikes 5—10 inches long, simple, solitary.

Occurs throughout the hills between 3,000 and 7,000 feet elevation. Very common in moist shady forest and in ravines of the inner ranges. Flowers: May-June.

4. *Boehmeria scabrella*, Gaud. Syn. *B. platyphylla* var. *scabrella*, Wedd. Vern. *Khāgsa*, Gen.—An erect deciduous or subdeciduous shrub 3—12 feet high with stems up to 2 inches diameter. Bark slightly rough owing to numerous small raised lenticels arranged more or less in longitudinal lines. Leaves opposite, 4—12 by 3—10 inches, broadly ovate, apex acute or acuminate but not abruptly so, dentate-serrate, base rounded or slightly cordate, very scabrid above and slightly so beneath, hirsute on both surfaces, upper surface rugose with much impressed reticulate veins which are prominent beneath, subcoriaceous, base strongly 3-nerved, the midrib with 4-5 pairs of lateral nerves above the basal. Petiole 1—12 inches long. Flowers monœcious, in clusters, the clusters arranged in axillary spikes. Male spikes 2—6 inches long, usually fascicled in the lower axils, mostly branched. Female spikes 4—8 inches long, simple, solitary in the upper leaf-axils. Fruiting spikes erect or pendent, up to 18 inches long.

Occurs throughout the area between 1,500 and 4,000 feet. Very common in shady forests and ravines, especially in the Bhabar tract where it is often somewhat gregarious. Flowers: August-September. Fruit: March.

2. URTICA, Linn. (*The stinging Nettles*.)

Herbs: rarely shrubby, with stinging hairs. Leaves opposite, toothed or lobulate, base 3—7-nerved; stipules lateral, free or connate. Flowers monœcious or diœcious, in axillary unisexual or androgynous cymose clusters. Male flowers: sepals 4, ovate, imbricate. Stamens 4, inflexed in bud. Pistillode cupular. Female flowers: sepals 4, outer usually smaller. Stigma brush-like. Achene embraced by the sepals, ovoid or oblong, compressed.

Urtica parviflora, Roxb. Vern. *Kandāli*, NG.—An erect under-shrub with stems 4—10 feet high and up to 2 inches diameter, distinctly woody at the base in old plants, but the twigs herbaceous. Bark pale yellowish or greenish-brown, lenticellate. Stems petioles and both leaf-surfaces bearing numerous straight or bent white stinging hairs up to 15 inch long. Leaves very variable in size, 3—10 by 1.5—5 inches, ovate or lanceolate, tapering to a long acuminate point, irregularly toothed, base rounded or cordate, membranous. Petiole 1—8 inches long. Stipules connate. Flowers small, green, monœcious, clustered on the branches of lax spreading axillary cymes 2—4 inches long. Sepals hispid. Fruit an achene embraced by the persistent sepals, of which the inner pair are twice as long as the outer.

Occurs throughout the area between 1,500 and 7,000 feet. Very common round villages, on waste ground, and in forest bordering streams. Sometimes more or less gregarious. Flowers: February—July.

3. MAOUTIA, Wedd.

Shrubs. Leaves alternate, crenate, base 3-nerved; stipules connate, intrapetiolar. Flowers minute, usually monœcious, in small cymose globose heads. Male perianth 5-partite. Stamens 5. Pistillode woolly. Female perianth none. Fruit an ovoid achene with a crustaceous or fleshy pericarp.

Maoutia Puya, Wedd. Vern. *Phurkhāgsa*, NG. *Safēd-khāgshi*, K and R.—An erect subdeciduous shrub often only 1-2 feet high but occasionally up to 7 feet high with stems 1·5 inches diameter. Bark reddish-brown, fairly smooth, lenticellate. Twigs hairy. Leaves 3·5—7 by 1·75—3·5 inches, elliptic, caudate-acuminate, coarsely toothed except near the base, upper surface pilose when young, scabrous with scattered hairs when mature, lower surface white-tomentose except on the pubescent nerves, base 3-nerved the lateral pair reaching to three quarters the length of the blade, prominent beneath. Petiole 1—5 inches long. Stipules connate, deeply 2-fid. Flowers monœcious or diœcious, minute, in small globose heads arranged in slender axillary dichotomous panicles ·5—1·5 inches long. Achenes brown, about ·05 inch long, hispid.

Occurs throughout the area between 1,500 and 5,000 feet. Common in open scrub and miscellaneous forests, especially on steep banks and exposed mineral soils such as road cuttings. The leaves turn very beautiful shades of orange, red and purple in the winter. Flowers: June—October. Fruit: November—January.

4. POUZOLZIA, Gaud.

Herbs or shrubs. Leaves alternate or opposite, usually entire, uppermost sometimes passing into bracts; stipules usually free. Flowers minute, in unisexual or androgynous clusters in the leaf-axils. Male perianth 4-5-rarely 3-partite or -lobed; lobes often dorsally gibbous or abruptly inflexed. Pistillode clavate or oblong. Female perianth tubular with contracted 2—4-toothed mouth, often angled or winged in fruit; stigma filiform. Fruit a small crustaceous achene, closely invested by the perianth.

Pouzolzia viminea, Wedd.—An erect shrub. Leaves alternate, 2—5 inches long, lanceolate, ovate- or oblong-lanceolate, caudate-acuminate, dentate with large teeth, smooth or somewhat rough above, strigose on the nerves beneath, basal nerves 3, extending more than half the length of the leaf. Petiole ·5—2 inches long. Stipules ·15 inch long, midrib hairy. Flowers small, usually monœcious, in dense axillary clusters with numerous ovate bracts. Male flowers; perianth 4-partite; stamens 4.

There is only one specimen of this plant collected from our area at Dehra Dun. This was collected by Duthie in the Sarju valley, Almora District, between 2,000 and 3,000 feet elevation, and Bageshar is also given as a locality in Strachey and Winterbottom's Catalogue. As regards its further distribution I am uncertain. The plant is apt to be mistaken for *Villebrunea frutescens*. Flowers: July—September.

5. VILLEBRUNEA, *Gaud.*

Trees or shrubs. Leaves alternate, penninerved or base 3-nerved; stipules partially connate. Flowers monœcious or dioecious, clustered, clusters axillary or from leaf-scars, sometimes in short lateral cymes or panicles. Male perianth 4-5-fid. Stamens 4. Pistillode clavate. Female perianth ovoid, mouth narrowed, somewhat fleshy in fruit. Ovary adnate to the perianth; stigma capitate, fimbriate. Fruit a crustaceous achene free or adnate to the perianth, the base of which is sunk in a fleshy cup which grows up round it.

Villebrunea frutescens, *Blume*.—An erect evergreen shrub 4–10 feet high with stems up to 2.5 inches diameter. Bark reddish-brown, slightly rough owing to numerous minute raised lenticels. Young shoots pubescent. Leaves 3.5–9 by 1.75–4.5 inches, ovate or elliptic, caudate-acuminate, serrate, membranous, scabrid on the upper surface, softly grey-tomentose when young, with scattered hairs above when mature, base strongly 3-nerved, the lateral pair extending more than half the length of the blade. Petiole .7–5.5 inches long. Stipules .3–.7 inch long, midrib hairy. Flowers small, dioecious, in paired sessile clusters .3–.4 inch diameter in the axils of fallen leaves on the old wood. Male flowers pinkish; perianth 3-4-partite; stamens 3-4. Female flowers green, with feathery white sessile stigmas. Achene brown, half immersed in the semi-transparent fleshy white perianth and bracteoles.

Occurs throughout the area between 1,500 and 5,500 feet. Common in shady moist ravines and often forming dense gregarious patches of undergrowth. Flowers: February–September. Fruit: October–January.

6. DEBREGEASIA, *Gaud.*

Shrubs or trees. Leaves alternate, 3-nerved at the base; stipules connate, intrapetiolar, 2-fid. Flowers monœcious or dioecious, in dense globose paniced spicate or sessile clusters. Male perianth 3–5- usually 4-partite; lobes valvate. Pistillode glabrous or woolly at the base. Female perianth ovoid or obovoid, succulent in fruit. Stigma sessile. Fruit an achene, at first adnate to the fleshy perianth.

Mature leaves smooth above. Flower-heads in dichotomous cymes ...

Mature leaves scabrid above. Flower-heads sessile or subsessile ...

... 1. *velutina*.

... 2. *hypoleuca*.

1. **Debregeasia velutina**, *Gaud.* Vern. *Tusarra*, *G. Tushiāri*, *A.*—

A shrub or small tree up to 25 feet high and 2.5 feet girth. Bark roughish, corky. Branches reddish-brown with prominent circular lenticels. Blaze .3–.5 inch, very fibrous, pink with a few pale yellowish bands towards the exterior. Leaves 3.5–7 by .5–1.25 inches, narrowly oblong-lanceolate, gradually narrowed to an acuminate point, serrulate; upper surface dull green, smooth but rugose due to the impressed nerves,

with a few scattered hairs more numerous on the midrib; lower surface white-tomentose with conspicuously raised venation; base 3-nerved, the lateral ones extending about half the length of the blade. Petiole .3—1.2 inches long. Stipules scarious. Flowers in compact globose heads .1-.2 inch diameter arranged in axillary dichotomous cymes. Heads 2—7 on peduncles .1—.4 inch long. Male flowers: perianth-lobes 4, exceeding the bracteoles. Fruit .15—.2 inch diameter, globose, consisting of a number of achenes contained in the fleshy perianths, yellow when ripe.

Occurs throughout the central and outer hill ranges between 2,000 and 5,000 feet. Common, usually bordering streams, sometimes forming gregarious patches. Flowers: September-October. Fruit: November-February.

2. *Debregeasia hypoleuca*, Wedd. Vern. *Tusarra*, G. *Tushiāri*, A. *Syanru*, NG.—A large evergreen shrub with stems up to 3 feet girth and 15 feet high. Bark reddish-brown, slightly rough owing to numerous small raised lenticels. Blaze .25 inch, white or pale yellow often with pink bands and streaks. Leaves 5—10 by 1.25—3 inches, oblong-lanceolate, gradually narrowed to an acuminate point, serrulate, upper surface scabrid and more or less hairy when mature, lower surface white-tomentose, base 3-nerved the lateral ones extending about half the length of the blade. Petiole .5—3 inches long, pinkish. Flowers dioecious, in compact globose heads which are sessile or on peduncles up to .05 inch long and arranged in axillary clusters. Male flowers: perianth-lobes 4, shorter than the bracteoles. Fruit .2—.25 inch diameter, globose, consisting of a number of achenes contained in the fleshy perianths, orange-yellow and sweet when ripe.

Occurs throughout the hills between 2,500 and 7,000 feet. Common in ravines and shady forest and often associated with *Quercus incana*. The leaves turn yellow before falling. Flowers: February-March. Fruit: May-July.

LXXXII.—MORACEÆ.

Trees or shrubs, rarely herbs, nearly always with milky latex. Leaves alternate, rarely opposite, simple, rarely deeply cut. Stipules often sheathing, deciduous. Flowers small, dioecious or monoecious, cymose but cymes often dense and becoming capitate, or sometimes spiciform, in some genera crowded on the outside or inside of fleshy receptacles formed of the growth and union of the floral axes. Perianth-segments 2—6, usually 4, valvate or imbricate, free or connate. Stamens equal in number to the perianth-segments or sometimes less. Female perianth often accrescent in fruit. Ovary superior, bicarpellary, 1-celled; styles 1-2, simple or bifid; ovule solitary. Fruit an achene or drupe or sub-2-valvular, often aggregated into large fleshy pseudocarps.

I.—Fruit formed from many flowers.

- | | | | | |
|--|-----|-----|-----|------------------------|
| 1. Armed | ... | ... | ... | 1. <i>Cudrania</i> . |
| 2. Unarmed. | | | | |
| (a) Male flowers in catkin-like spikes | ... | | | 2. <i>Morus</i> . |
| (b) Male flowers arranged like the female on the surface of a globose or oblong receptacle | ... | | | 3. <i>Artocarpus</i> . |
| (c) Male flowers arranged like the female on the inside of a hollow receptacle (fig) | ... | | | 4. <i>Ficus</i> . |

II.—Fruit the result of 1 flower. Male flowers in small globose heads

5. *Streblus*.1. CUDRANIA, *Trecul*.

Trees or shrubs, often scandent, usually spinous. Leaves alternate, entire, penninerved; stipules lateral, small. Flowers dioecious, in lateral 1—3-nate peduncled globose heads. Male flowers each surrounded by 2—4 bracts more or less adherent to the perianth; perianth-segments 3—5, imbricate; stamens more or less adnate to the segments; pistillode subulate or none. Female flowers distinct, perianth embracing the ovary. Style simple or 2-partite. Achenes numerous, enclosed in the fleshy pseudocarp formed of the accrescent bracts and perianth.

Cudrania javanensis, *Trecul*.—A rambling evergreen or subdeciduous shrub, the branches often subscandent or trailing and forming a dense bush; stems up to 30 feet high and 2 feet girth. Bark yellowish- or orange-brown sometimes orange-red towards the base, rough, exfoliating in irregular papery flakes; smooth grey and lenticellate on the branches. Stems and branches armed with stout usually straight thorns up to 2·5 inches long. Young shoots pubescent. Blaze 2·5 inch, fibrous, yellow exuding a creamy juice. Leaves variable in size, usually 1·5—4 by

·75—2·25 inches, elliptic or obovate, obtuse, acute or acuminate, base acute or rounded, subcoriaceous, dark green above, glabrous; lateral nerves slender 8—12 pairs. Petiole ·2—·7 inch long. Flowers in dense globose shortly pedunculate heads about ·25 inch diameter, 1-2 together in the leaf-axils. Male flowers with 3—5 perianth-lobes adnate to 2—4 imbricate bracts. Stamens 4, erect. Female flowers with 4 thickened perianth-lobes velvety at the tips. Fruit an irregularly shaped compound berry ·7—1·2 inches diameter, pinkish-orange and velvety when ripe.

Has only been collected from the East Almora and Haldwani Divisions but will probably be found to occur along the subhimalayan tract and outer hill ranges to the west of this also since it is common around Dehra Dun. Flowers: April—June. Fruit: August.

2. MORUS, Linn. (*The Mulberries.*)

Trees or shrubs with milky juice. Leaves alternate, entire toothed or 3-lobed, palminerved; stipules caducous. Flowers spicate, monoëcious or dioecious; perianth-lobes 4, rarely 3, imbricate, those of the female fleshy and swollen in fruit. Pistillode turbinate. Style central, 2-partite or 2-fid. Fruit of many achenes enclosed in the succulent more or less confluent perianths.

I.—Teeth of leaves coarse, the lateral nerves running straight into the teeth or forked within the margin. Fruit 1 inch long or less.

- | | |
|--|--------------------|
| 1. Leaves usually 2·3 inches long. Male spikes less than 1 inch long ... | 1. <i>indica.</i> |
| 2. Leaves usually 3—6 inches long. Male spikes 1·5—3·5 inches long ... | 2. <i>serrata.</i> |

II.—Teeth fine, the lateral nerves abruptly curved upwards within the margin. Fruit 2 inches long or more ... 3. *lævigata.*

1. *Morus indica*, Linn.—A deciduous shrub or medium-sized tree. Leaves variable, usually 2-3 inches long, ovate, acuminate often caudate, usually undivided sometimes more or less deeply lobed, serrate or crenate-serrate, usually scabrous above and slightly pubescent on the nerves beneath, base truncate rounded or subcordate and 3-nerved; lateral nerves 3-4 pairs, branched within the leaf margin. Petiole usually ·4—1·2 inches long. Male spikes 3—6 inch long, shortly cylindric, pubescent, on short peduncles. Female spikes ovoid, ·2·3 inch long; peduncle slender, ·25—·4 inch long. Styles long, hairy, connate for one fourth their length. Fruit ·2—·5 inch long, ovoid or cylindric, black when ripe.

According to Brandis and Duthie this species is found wild in the subhimalayan tract and outer hill ranges up to 7,000 feet. This statement I think requires confirmation. It is certainly found cultivated in this region between 1,000 and 2,000 feet elevation. Flowers: February-March. Fruit: May.

2. *Morus serrata*, *Roxb.* Vern. *Kimu*, Gen.—A medium-sized deciduous tree up to 9 feet girth and 70 feet high. Bark dark grey or reddish-brown, rough, exfoliating in irregular woody strips and scales. Blaze .5—1 inch, rather hard, white mottled with yellow or pale yellow mottled with light brown, exuding a milky juice. Leaves variable, usually 3—6 inches long, broadly ovate, acuminate or caudate, often deeply 3—5-lobed on young trees and vigorous shoots, usually coarsely and sharply serrate, teeth usually unequal and cuspidate, base rounded truncate or cordate and 3- or 5-nerved, pubescent or tomentose when young, rather rough when mature and glabrous except along the nerves beneath; lateral nerves 5—7 pairs, their tips running nearly straight into the teeth. Petiole usually 1-2 inches long. Flowers dioecious, greenish. Male spikes 1.5—3.5 inches long, dense, villous. Female spikes .4-.5 inch long, shortly cylindric; peduncle .1-2 inch long, villous. Fruit .4—1 inch long by .35 inch diameter, sweet, white pink or purplish.

Occurs throughout the hills between 3,500 and 9,000 feet. Not very common. Flowers: April-May. Fruit: May-June.

3. *Morus lævigata*, *Wall.*—A medium-sized deciduous tree up to 10 feet girth and 80 feet high. Bark dark reddish-brown, rough, exfoliating in irregular woody strips and scales; branches and young stems smooth and thickly covered with circular lenticels which tend to coalesce in transverse lines. Blaze .25—.5 inch, not or shortly fibrous, white more or less banded with orange towards the exterior, exuding a milky juice. Leaves variable, usually 5—10 by 3—7 inches, ovate or elliptic-ovate, acuminate usually caudate, usually undivided but sometimes more or less deeply 3—5-lobed, finely crenate-serrate, base rounded or subcordate and 3-nerved, somewhat scabrid above, puberulous especially on the nerves beneath when young; lateral nerves 5—7 pairs, their tips abruptly curved upwards near the margin. Petiole usually 1-2 inches long, terete. Flowers greenish, in drooping cylindric spikes. Male spikes 1.5—2.5 inches long, dense, villous. Female spikes 1.5—3.5 inches long; peduncle .3—.6 inch long; peduncle and rachis villous. Fruit 2-3.5 inches long, white or dark purple, sweet.

Probably occurs throughout the subhimalayan tract and outer hill ranges between 1,000 and 2,000 feet. In the Ramnagar Division it is found mainly in shady ravines, and is not very common. An old hollow tree near Sitabani measured 17 feet girth and 40 feet high. The leaves turn yellow as they fall. Flowers: February-March.

3. ARTOCARPUS, *Forst.*

Evergreen trees with milky juice. Leaves alternate, coriaceous, often large, penninerved. Flowers monœcious, densely crowded on globose or variously shaped unisexual, usually axillary, solitary receptacles, often mixed with peltate bracts. Male perianth 2—4-lobed or partite, lobes concave; stamen 1; pistillode none. Female perianth

tubular, confluent below with the receptacle, mouth minute; stigma entire, rarely 2-3-fid. Fruit a large fleshy syncarp covered superficially with the fleshy perianths and the usually apically spinous or otherwise hardened carpels, the lower parts of which are deeply sunk in the syncarp.

Artocarpus Lakoocha, Roxb. Vern. *Dhaun*, Gen.—A fairly large deciduous tree up to 8 feet girth and 60 feet high. Bark dark reddish-brown, rough, exfoliating in irregular small woody scales. Blaze 3—6 inch, fibrous, pink, exuding a milky juice. Young parts clothed with soft grey or tawny tomentum. Leaves 6—10 by 3·5-6 inches, elliptic or obovate, apex with an abrupt short acumen, base rounded or obtuse, entire or obscurely serrulate, coriaceous, dark glossy green and glabrous above, paler and somewhat harshly hairy beneath when mature; lateral nerves 10—13 pairs, these and the reticulate nerves between conspicuous and raised beneath. Petiole 7—1·3 inches long, stout, terete, pubescent. Stipules 5 inch long, lanceolate. Receptacles axillary, males subsessile from the previous year's, females short-peduncled from the current year's axils. Male receptacles spongy, yellow, irregularly oblong, 1-2 inches long, deciduous. Fruit a much enlarged fleshy receptacle 2-3 inches diameter, lobulate, velvety, yellow.

Occurs throughout the subhimalayan tract and outer hill ranges up to 4,000 feet. Apparently not very common. Generally in open ravines and moist localities. The leaves turn bright yellow as they fall. Flowers: April. Fruit: July.

4. *FICUS*, Linn. (*The Figs*.)

Trees or shrubs with milky juice, often epiphytic when young, sometimes scandent. Leaves alternate, rarely opposite, usually coriaceous and entire; stipules sheathing the bud. Flowers minute, often mixed with bracteoles, unisexual, on the inner surface of a fleshy receptacle of which the narrow mouth is more or less completely closed by small imbricating bracts. Receptacles androgynous with the fewer males nearest the mouth, or sometimes unisexual. Unfertile female flowers (gall flowers) occupied by the larva or pupa of a hymenopterous insect are present in the androgynous or functionally male recepts. Male perianth 2—6-fid or-partite; stamens 1-2, rarely 3—6. Female flowers with perianth similar to the male, or reduced. Fruit of numerous crustaceous or fleshy achenes included in the accrescent fleshy syncarp (fig).

- | | | |
|---|--------|------------------------|
| 1. Scandent, clinging closely to support by means of adventitious roots | ... .. | 2. |
| Erect or suberect | ... .. | 3. |
| 2. Lateral nerves 4-5 pairs including the basal | | 13. <i>scandens</i> . |
| Lateral nerves 6-10 pairs including the basal | | 14. <i>foveolata</i> . |

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|--|-----|-----|-----|-------------------------|
| 3. Leaves opposite | ... | ... | ... | 4. |
| Leaves alternate | ... | ... | ... | 5. |
| 4. Leaves 2—5 inches broad, not clustered at the ends of the branches | ... | ... | ... | 10. <i>hispida</i> . |
| Leaves .75—1.75 inches broad, clustered at the ends of the branches | ... | ... | ... | 11. <i>laminosa</i> . |
| 5. Figs on special leafless branches or in clusters on the old wood | ... | ... | ... | 6. |
| Figs axillary | ... | ... | ... | 9. |
| 6. Leaves very unequal-sided at the base | ... | ... | ... | 12. <i>Cunia</i> . |
| Leaf-base symmetrical or nearly so | ... | ... | ... | 7. |
| 7. Basal nerves 5—7 | ... | ... | ... | 17. <i>Rozburghii</i> . |
| Basal nerves 3 | ... | ... | ... | 8. |
| 8. Leaves 3—6 inches long, entire | ... | ... | ... | 19. <i>glomerata</i> . |
| Leaves 5—12 inches long, toothed | ... | ... | ... | 18. <i>pomifera</i> . |
| 9. Leaves scabrous on one or both sides | ... | ... | ... | 10. |
| Leaves not scabrous on either side | ... | ... | ... | 11. |
| 10. Leaves rough on both surfaces, glabrous | ... | ... | ... | 9. <i>clavata</i> . |
| Leaves only rough on the lower surface, glabrous | ... | ... | ... | 1. <i>gibbosa</i> . |
| Leaves only rough on the upper surface, pubescent | ... | ... | ... | 15. <i>palmata</i> . |
| 11. Petiole .5 inch long or less | ... | ... | ... | 4. <i>retusa</i> . |
| Petiole exceeding .5 inch long | ... | ... | ... | 12. |
| 12. Figs pedunculate | ... | ... | ... | 13. |
| Figs sessile | ... | ... | ... | 16. |
| 13. Peduncles and figs hairy | ... | ... | ... | 8. <i>infectoria</i> . |
| Peduncles and figs glabrous | ... | ... | ... | 14. |
| 14. Leaves 3—6 inches broad, broadly ovate | ... | ... | ... | 7. <i>Arnottiana</i> . |
| Leaves less than 3 inches broad, lanceolate | ... | ... | ... | 15. |
| 15. Lateral nerves nearly straight. Tip rather abruptly acuminate | ... | ... | ... | 3. <i>glaberrima</i> . |
| Lateral nerves arcuate. Tip gradually acuminate | ... | ... | ... | 16. <i>nemoralis</i> . |
| 16. Leaves obtuse or shortly acuminate. Figs white, pink or red when ripe | ... | ... | ... | 17. |
| Leaves caudate acuminate. Figs purplish-black when ripe | ... | ... | ... | 18. |
| 17. Figs .25—.35 inch diameter, white or pink when ripe | ... | ... | ... | 8. <i>infectoria</i> . |
| Figs .5—.7 inch diameter, red when ripe | ... | ... | ... | 2. <i>bengalensis</i> . |
| 18. Acumen less than 1 inch long. Lateral nerves 6—9 pairs including the basal | ... | ... | ... | 5. <i>Rumphii</i> . |
| Acumen 1—3 inches long. Lateral nerves 8—12 pairs including the basal | ... | ... | ... | 6. <i>religiosa</i> . |

1. **Ficus gibbosa, Blume.**—An evergreen shrub or small tree, usually epiphytic, attaining 40 feet high with stem up to 6 inches diameter. Bark pale greenish-brown or ashy, with or without very minute scattered lenticels, smooth. Blaze .2 inch, white or yellowish mottled with pale orange, juice milky. Leaves alternate, 4—9 by 1.75—4 inches; elliptic oblong or sub-obovate, often unequal-sided, entire or sinuate, thinly coriaceous, glabrous and dark glossy green above (not scabrid),

glabrous pale and scaberulous beneath, base usually acute and uneven; lateral nerves 6—8 pairs including a strong obliquely ascending basal pair, prominent beneath. Petiole .2—.8 inch long. Figs .4-.5 inch long, obovoid, greenish-or orange-yellow, without basal bracts, clothed with short scabrid hairs, stalked, solitary or in pairs, axillary. Peduncles .1-.2 inch long.

Occurs throughout the subhimalayan tract and outer hill ranges up to 2,000 feet. Fairly common. In ravines I have found it growing on boulders and not epiphytic. The species here described is var. *cuspidifera*, King. Figs ripen January—March.

2. *Ficus bengalensis*, Linn. Vern. *Bar* or *Bargat*, Gen. *Ban*, A. Eng. The *Banyan*.—A large evergreen tree producing numerous aerial roots from the branches which if they reach the ground thicken rapidly and form supports to the crown. Bark dark grey, smooth. Blaze .4—.8 inch, hard outside, fibrous inside, pale yellow mottled with orange, sometimes with pink streaks, exuding a milky juice. Young parts softly pubescent. Leaves alternate, 4—8 by 2—5 inches, ovate or elliptic, entire, obtuse, coriaceous, dark glossy green above, base rounded subcordate or slightly narrowed and 3—7-nerved, lateral nerves 4—7 pairs prominent beneath and joined within the margin by loops, reticulations prominent beneath. Petiole .5—2 inches long, stout, not jointed to the blade. Stipules .7—1 inch long, coriaceous. Figs .5—.7 inch diameter, supported by 3 rounded bracts, sessile, in axillary pairs, globose, puberulous, red when ripe.

Occurs throughout the area up to 4,000 feet. Very common in the subhimalayan tract. It is epiphytic when young. Figs ripen October–November and again April–May.

3. *Ficus glaberrima*, Blume.—A small glabrous tree up to 4.5 feet girth and 40 feet high. Bark pale yellowish-or greenish-brown or pale orange, smooth except for the presence of numerous small circular dark brown lenticels which tend to coalesce in either vertical or horizontal lines. Blaze .25—.5 inch, fibrous, uniformly pink or white more or less banded with pinkish-brown outside, exuding a milky juice. Leaves alternate, 4—8 by 1.5—3 inches, elliptic-oblong or ovate-lanceolate, rather abruptly blunt-acuminate, entire, base rounded or acute, subcoriaceous, dark glossy green above, pale beneath; lateral nerves 8—12 pairs including the rather strong and obliquely ascending basal pair, nearly straight, joined by loops within the margin. Petiole .5—1.75 inches long. Stipules .5 inch long. Figs .4-.5 inch long, supported by 3 basal bracts, stalked, axillary, solitary or in pairs, obovoid, orange or red when ripe. Peduncles .2—.5 inch long.

Occurs throughout the subhimalayan tract and outermost hill ranges between 1,000 and 2,500 feet. Rather scarce. Usually in shady ravines. Figs ripen February—April.

4. *Ficus retusa*, Linn.—A medium-sized evergreen glabrous tree up to 12 feet girth and 65 feet high, with dense umbrageous crown.

Twigs rather slender. Bark smooth, pale grey or pale brown with numerous small circular paler lenticels more or less arranged in short transverse lines. Blaze .25—.5 inch, very hard, fibrous towards the interior, pink inside orange outside, exuding copious milky juice. Leaves alternate, 2—4.5 by 1-2 inches, elliptic elliptic-ovate or obovate, acute or bluntly short-acuminate, entire, base obtuse or acute, thickly coriaceous, smooth and glossy on both surfaces, dark green above; lateral nerves about 10—15 pairs, very indistinct, parallel, joined within the margin, the lowest pair basal stronger and ascending obliquely. Petiole .2—.5 inch long. Stipules .4 inch long. Figs .4—.5 inch diameter, supported by 3 broadly ovate bracts, sessile, axillary, solitary or in pairs, depressed-globose, pale orange-yellow often tinged purple when fully ripe.

Occurs in the subhimalayan tract and outermost hill ranges up to 3,000 feet elevation. Fairly common, often associated with *sal*. It is usually epiphytic when young. The branches occasionally produce aerial roots as in *F. bengalensis*. Figs ripen February—April and again August.

5. Ficus Rumphii, Blume. Vern. *Kabāru*, SG.—A medium-sized or large deciduous glabrous tree up to 11 feet girth and 90 feet high. Bark pale greenish-grey or greenish-brown, quite smooth, sometimes with horizontal wrinkles, and with numerous small dark circular lenticels. Blaze .3—.6 inch, variable, often pale orange or bright pinkish with or without orange bands, very hard, an innermost layer white or pink and very fibrous, exuding a milky juice. Leaves alternate, 4—7 by 2.75—4 inches, broadly ovate, acuminate, the acumen less than 1 inch long, entire, undulate, base cuneate or truncate, usually slightly narrowed towards the petiole, subcoriaceous, glossy on both surfaces, base 3—5-nerved, the second pair usually from a little above the base; lateral nerves 6—9 pairs including the basal, joined within the margin by loops. Petiole 1.75—3.5 inches long, slightly flattened above. Stipules .5—1 inch long. Figs .5—.8 inch diameter, supported by 3 rounded bracts, one of which is deeply 2-lobed, sessile, in axillary pairs, globose, purplish-black with paler dots when ripe.

Occurs throughout the area up to 4,000 feet. Very common in the Bhabar where it is frequently associated with *sal*. Often epiphytic when young. Apt to be mistaken for *F. religiosa*. Figs ripen May—July and again November.

6. Ficus religiosa, Linn. Vern. *Pipal*, Gen.—A large deciduous glabrous tree. Bark smooth, very pale pinkish-brown; exfoliating in irregular woody scales. Blaze .5—.9 inch, rather hard outside, very fibrous inside, pink or reddish with or without paler bands, turning orange-brown on exposure, exuding a milky juice. Leaves alternate, 4—7 by 2.5—4.5 inches, broadly ovate, rather abruptly narrowed into a linear-lanceolate acumen 1—3 inches long, entire, often sinuate, subcoriaceous, glossy on both surfaces, base rounded or truncate and

5—7-nerved; lateral nerves 8—12 pairs including the basal, joined within the margin by loops. Petiole 3-4 inches long, slender. Stipules minute. Figs .5 inch diameter, supported by 3 rounded bracts, sessile, in axillary pairs, depressed-globose, dark purple when ripe.

Probably only indigenous in the subhimalayan tract and outermost hill ranges up to 4,000 feet, but planted up to 5,000 feet throughout the hills. Rather scarce in the wild state. Often epiphytic when young. Figs ripen October-November and again April-May.

7. **Ficus Arnottiana**, *Miq.*—An evergreen glabrous shrub or small tree up to 4 feet girth and 25 feet high. Bark pale pinkish-or yellowish-brown, roughish, lenticellate, exfoliating in irregular woody scales. Blaze .25—.35 inch, hard, somewhat fibrous, pinkish-brown usually mottled or streaked with reddish-brown towards the exterior, exuding a milky juice. Young shoots smooth with a deciduous glaucous bloom. Young shoots and leaves, stipules and petioles often bright pink. Leaves alternate, 3.5—8 by 3—6 inches, broadly ovate, gradually narrowed to a short blunt acumen or sometimes bluntly acute, entire, base more or less deeply cordate, never narrowed into the petiole and 5—7-nerved, subcoriaceous, rather dark glossy green above, with paler main nerves; lateral nerves 8—10 pairs including the basal, joined by loops within the margin. Petiole 1.5—5.5 inches long, shallowly channelled. Stipules 1.5—2.5 inches long. Figs .5—.75 inch diameter, supported by 3 membranous bracts, axillary, pedunculate, 1—4 together, depressed-globose, purple with greenish dots when ripe. Peduncles .1—.3 inch long, stout.

Occurs throughout the hills between 1,500 and 4,500 feet. Fairly common on steep rocky ground, the stems often wedged into crevices in the rocks. Figs ripen July.

8. **Ficus infectoria**, *Roxb.* Vern. *Pilkha*, NG. *Pilkhan*, H and R. *Pilak*, A.—A deciduous glabrous tree or shrub. Bark smooth or slightly rough, pale ashy or dark grey with silvery portions. Leaves alternate, 3.5—7 by 1.5—3 inches, ovate or oblong, rather abruptly and shortly acuminate, entire, often sinuate, subcoriaceous, base rounded subcordate or cuneate; lateral nerves 7—10 pairs including the basal pair which is often stronger and obliquely ascending, joined within the margin by loops. Petiole 1-2.25 inches long, channelled. Stipules about .5 inch long. Figs .25—.35 inch diameter, supported by 3 minute bracts, sessile, axillary, 2—4 together, depressed-globose, glabrous, white or pinkish with pinkish-brown dots.

The plant described above is the typical form which is found throughout the area between 1,000 and 6,500 feet. Very common. In the hills it is usually seen as a large subsucculent shrub growing in crevices on steep rocks. Figs ripen May-June and again October.

Var. **Lambertiana**, (*sp. Miq.*). This has been collected in the Jaspur range of the Ramnagar Division. It is distinguished by the larger size

of the figs, 3-4 inch diameter, which are situated on short pubescent peduncles 2-3 inch long. In the specimens at Dehra Dun the figs are also densely clothed all over with white tomentum.

9. *Ficus clavata*, Wall. Vern. *Chanchari*, Gen.—An evergreen shrub or small tree. Bark dark reddish-brown, fairly smooth, covered with minute raised lenticels. Blaze 1-5 inch, yellowish-white often mottled with pinkish-brown towards the exterior, fibrous towards the interior, exuding a thick creamy juice. Twigs scabrid. Leaves alternate 3-5-7 by 1-2 inches, oblong-lanceolate or oblanceolate, abruptly caudate-acuminate, usually with coarse rounded teeth in the upper half, rarely entire, glabrous but rough on both surfaces, thinly coriaceous, dull dark green above often tinged with yellow, base narrowed; lateral nerves 5-8 pairs including the lowest obliquely-ascending sub-basal pair, prominent beneath, joined within the margin, with prominent reticulations between. Petiole 1-2-5 inch long. Stipules 3-4 inch long. Figs 1-2-5 inches diameter, supported by minute bracts, stalked, axillary, solitary rarely paired, obovoid or globose, rough more or less wrinkled and warted, yellow or reddish when ripe. Peduncles 1-2 inch long.

Occurs throughout the area between 1,500 and 5,000 feet. Common on steep rocky ground especially in ravines. Often cultivated for fodder. Figs ripen May-June and again October.

10. *Ficus hispida*, Linn. Vern. *Tōtmila*, R.—A small evergreen tree up to 3 feet girth and 20 feet high. Bark pale ashy or greenish-grey, smooth and often horizontally wrinkled. Blaze 2-5 inch, not or scarcely fibrous, pink or pinkish-brown usually with a few whitish streaks, exuding a milky juice. Twigs hollow. Leaves opposite or rarely alternate, rather variable in size, usually 5-10 by 2-5 inches, broadly ovate or obovate-oblong, acute or shortly-acuminate, usually toothed, scabrid and hairy on both surfaces, dull dark green above pale beneath, base cuneate rounded or subcordate; lateral nerves 5-8 pairs prominent beneath. Petiole 5-3 inches long. Stipules 5 inch long, ovate-lanceolate. Figs clustered on stout leafless branches up to about 2 feet long from the main stem or larger branches or on young plants axillary; 5-1 inch diameter, ovoid, hispid, supported by 3 small bracts and sometimes bearing small brown scales on the surface, yellow when ripe. Peduncles 2-6 inch long.

Occurs throughout the subhimalayan tract and central and outer hill ranges up to 8,500 feet. Fairly common along the base of the hills. Figs ripen July.

11. *Ficus laminosa*, Hardw. Syn. *F. saemocarpa*, Miq.—An evergreen shrub with erect or suberect stems 1-4 feet high and up to 3 inches diameter. Bark reddish-brown, smooth. Blaze less than 1 inch, pinkish, fibrous, tardily exuding a milky juice. Young shoots hairy. Leaves opposite, crowded at the ends of the branches, 3-5-7 by

·75—1·75 inches, narrowly oblanceolate, acuminate, entire, base narrowed, more or less hairy on both surfaces when young especially on the nerves beneath, glabrescent when mature or with scattered pale brown adpressed hairs above and on the nerves beneath, dark glossy green above, usually somewhat scabrid beneath; main lateral nerves 6—10 pairs arcuate, including a weak ascending basal pair. Petiole ·3—1·3 inches long. Stipules ·3—·5 inch long, persistent. Figs ·8—1·4 inches diameter, with scattered bracts near the base, stalked, solitary and axillary or in short leafless panicles from the old wood, subglobose, hispid, yellowish-green when ripe with pale raised dots and 8—10 longitudinal ribs. Peduncles ·15—·3 inch long.

Occurs throughout the subhimalayan tract and central and outer hill ranges. Fairly common. It is found on the banks of streams and often in the crevices of partially submerged rocks. The spreading stems root adventitiously and may become half buried in sand and shingle. Figs ripen January-February and probably again July.

12. *Ficus Cunia*, Buch.-Ham. Vern. *Khaina* or *Khunia*, Gen.—A small or medium-sized evergreen or subdeciduous tree up to 5 feet girth and 40 feet high. Bark reddish-brown, roughish, exfoliating in irregular woody strips and scales. Blaze ·3—·5 inch, rather hard, pink sometimes with yellowish bands, exuding a creamy yellow juice. Young shoots pubescent. Leaves alternate, very variable in size, usually 5—8 by 2·3 inches, usually elliptic or oblong-lanceolate, acuminate, entire or serrate, coriaceous, dark glossy green above, scabrid on both surfaces or pubescent beneath, occasionally smooth above, base very unequal, one side with a 3-4-nerved rounded lobe; lateral nerves 9—14 pairs, prominent. Petiole ·2—·6 inch long, stout, scabrid. Stipules ·7—1·7 inches long. Figs in pairs or small clusters on leafless scaly shoots up to 12 feet long and 2 inches diameter from the larger branches or from the main stem near the base, shortly pedunculate, ·4—·8 inch diameter, globose or pyriform, pinkish or greenish-yellow when ripe.

Occurs throughout the area up to 4,000 feet. Common, often on the banks of streams or on steep rocky ground. Figs ripen July—September.

13. *Ficus scandens*, Roxb. Vern. *Bēduli*, G, R and K.—An extensive evergreen climber with stems up to 6 inches diameter and 40 feet high, adhering closely to its support by means of adventitious roots, and giving off reproductive side branches 2—4 feet long. Bark pale ashy or silvery brown, fairly smooth with numerous small raised lenticels often arranged in transverse lines. Blaze ·35—1 inch, rather hard, bright pink or deep purplish-red, exuding milky juice. Young shoots pubescent. Leaves alternate, on reproductive shoots 2·5—5 by 1·75—3 inches, ovate or elliptic, acute, entire, very coriaceous, glabrous, quite smooth and rather glossy above, base rounded or narrowed; lateral nerves 4-5 pairs, arcuate, prominent beneath, joined within the margin,

the basal pair strong. Petiole .3—1 inch long. Stipules .25 inch long. Figs .3-.4 inch diameter, supported by 3 ovate bracts, axillary, solitary or in pairs, globose or ovoid, orange-yellow or pinkish with distant pale dots when ripe. Peduncle .3—.6 inch long.

Occurs throughout the hills between 1,500 and 3,000 feet. Common. Growing equally on trees and on precipitous rocks in ravines, sometimes creeping over the ground. Figs ripen February—April.

14. *Ficus foveolata*, Wall. Vern. *Bēduli*, G, R and K.—A fairly extensive evergreen climber with stems up to 2 inches diameter and 50 feet high, adhering closely to its support by means of adventitious roots and giving off reproductive side branches 2—5 feet long. Bark pale or dark brown often reddish, slightly rough owing to numerous small circular raised lenticels. Blaze .2—.35 inch, white or pink closely mottled and streaked darker, exuding a milky juice. Young shoots and twigs rusty-pubescent. Leaves alternate, variable in size, on reproductive shoots usually 3—7 by 1.5—2.5 inches, ovate elliptic or oblong, acuminate, entire, base rounded or cuneate, thinly coriaceous, glabrous above, more or less rusty-pubescent beneath especially on the nerves, shining dark green above, with conspicuous raised reticulate venation beneath; lateral nerves 6—10 pairs including the strong basal pair, prominent beneath. Leaves on sterile shoots often only 1—1.5 inches long. Petiole .3—1.2 inches long, rusty-pubescent. Stipules up to .5 inch long. Figs .6—.75 inch diameter, supported by 3 ovate bracts, axillary, solitary, globose, glaucous, sparsely rusty-hairy, purple when ripe. Peduncle .1—.5 inch long.

Occurs throughout the hills between 2,000 and 7,500 feet. Very common. Growing equally on trees and on precipitous rocks, usually in shady moist ravines, frequently creeping over the ground. Figs ripen March-April.

15. *Ficus palmata*, Forsk. Vern. *Bēdu*, Gen.—A small deciduous or subdeciduous tree up to 5.5 feet girth and 40 feet high with short bole and rounded crown. Bark pale sometimes silvery grey, smooth, lenticellate. Young parts tomentose or pubescent. Leaves alternate, rather variable, usually 3—6 by 2.5—5 inches, orbicular or broadly ovate, rounded or acute, crenate-dentate, often deeply lobed on young plants, base rounded or cordate, scabrous and dull green above, pubescent or softly tomentose beneath with conspicuous pale venation; lateral nerves 4—6 pairs including the strong basal pair. Petiole 1-2.5 inches long. Stipules .3—.5 inch long. Figs .5—1 inch diameter, supported by 3 or more deciduous bracts, axillary, solitary or in pairs, pyriform, dark purple or sometimes pink when ripe. Peduncle .5—1 inch long.

Occurs throughout the area up to 6,000 feet. Common in open places, especially along the banks of streams and rivers. Frequently cultivated in the hills both for its fodder and fruit. Figs ripen June—August.

16. *Ficus nemoralis*, Wall. Vern. *Thēlka*, NG.—A small sub-deciduous glabrous tree up to 4·5 feet girth and 35 feet high. Bark grey or reddish-brown, smooth, lenticellate. Blaze 2·5—3·5 inch, hard, pale yellow mottled with brown or orange, exuding a milky juice. Leaves alternate, 4·5—10 by 1·25—2·5 inches, lanceolate or elliptic-lanceolate, narrowed to a long acumen, entire, membranous, base acute; lateral nerves 10—14 pairs including a weak obliquely ascending basal pair, arcuate, slender; reticulations dark-coloured, conspicuous on the lower surface. Petiole 6—1·7 inches long. Stipules 4—7·5 inch long. Figs 3 inch diameter, supported by 3 connate bracts, axillary, solitary or in pairs, subglobose, reddish when ripe. Peduncle 2—4 inch long.

Occurs throughout the hills between 4,000 and 6,500 feet. Fairly common, usually in oak forest. Often cultivated for its fodder. Young leaves pinkish, the pink on the petioles and midrib beneath often persisting when the leaves are mature. Figs ripen April and again October-November. The species here described is var. *Fieldingii*, Miq.

17. *Ficus Roxburghii*, Wall. Vern. *Timla*, G. *Timūl*, A.—A small evergreen or nearly evergreen tree up to 4 feet girth and 35 feet high. Bark grey or pinkish-brown, smooth or somewhat rough, exfoliating in small woody scales. Blaze 3—7 inch, not or shortly fibrous, deep pink exuding a milky juice. Twigs with large pith, rarely hollow. Leaves alternate, 4—10 by 3—8 inches or sometimes larger, broadly ovate or rounded, usually acute, entire (often crenate-serrate on young or mutilated plants), subcoriaceous, dark green smooth and glabrous or nearly so above, softly pubescent beneath, base usually deeply cordate and 5—7-nerved; lateral nerves 3-4 pairs above the basal, joined by almost straight parallel transverse veins. Petiole 1—8 inches long. Stipules 6—1 inch long, ovate-lanceolate. Figs in clusters on short thick leafless branches on the main stem often near the ground or on the larger branches, up to 3 inches across and 2 inches long, supported by 3 ovate or triangular bracts, pyriform, purplish-orange or pink when ripe. Peduncles 7—1·7 inches long.

Occurs throughout the hills between 1,500 and 5,500 feet. Common on hot southern aspects, especially in *chir* forests. Often cultivated for its fodder and fruit. Figs ripen April—August.

18. *Ficus pomifera*, Wall. Vern. *Gwāl-timla*, G.—An evergreen shrub or small tree with stems attaining 15 feet high and 3 feet girth. Bark reddish-brown sometimes a deep reddish, smooth. Blaze 2—5 inch, rather hard, not or shortly fibrous, pinkish or reddish often streaked paler, exuding a milky juice. Twigs often hollow when young. Young shoots puberulous. Leaves alternate, variable in size, usually 5—12 by 2·5-6 inches, narrowly ovate, elliptic or oblong, irregularly and distantly toothed, glabrous and dark rather glossy green above, more or less puberulous beneath, base rounded or slightly cordate and 3-nerved

sometimes with a very weak additional pair below; lateral nerves 4—8 pairs including the basal, prominent beneath. Petiole 1—5·5 inches long. Stipules 5—7·5 inch long, ovate-lanceolate. Figs in clusters on short thick leafless branches situated on the main stem from ground level upwards and on the main branches, 5—1 inch diameter, supported by 3 basal bracts, depressed-globose, more or less pubescent, pink or reddish with pale tubercular spots when ripe. Peduncles 3—1·5 inches long.

Has been collected in the North and South Garhwal and Naini Tal Divisions where it occurs up to 5,000 feet along the banks of streams, but is rather scarce. Here it is found as a shrub, only 2—4 feet high, with the stems usually tightly wedged into rock crevices. In the Dun however it attains the dimensions of a small tree and is found in swampy localities. The stem is seldom entirely erect, the lower portion sometimes spreading in an irregular fashion along the ground surface for a distance up to 30 feet. In the Dun it is found at 1,000 feet elevation. This plant had not till recently been recorded west of Sikhim, where according to Dr. King it attains much larger dimensions. Figs ripen November-December, and again May-June.

19. *Ficus glomerata*, Roxb. Vern. *Gūlar*, Gen.—A large deciduous tree up to 15 feet girth and 90 feet high. Base of stem usually deeply buttressed. Bark smooth, pale yellowish or greenish-brown, often much darker and roughish on very old trees, exfoliating in irregular woody plates. Blaze 4—7 inch, rather hard, not or slightly fibrous towards the interior, pale yellow streaked with pink or uniformly bright reddish turning orange-brown on exposure, exuding milky juice. Leaves alternate, 3—6 by 1·5—2·75 inches, ovate or elliptic-ovate, tapering to a rather blunt point, entire, glabrous on both surfaces when mature, base usually rounded sometimes acute; lateral nerves 6—7 pairs including the rather strong basal pair. Petiole 1-2 inches long. Stipules 3—8 inch long, ovate-lanceolate. Figs on stout leafless branches up to 2 feet long, issuing from the stem and larger branches, rarely axillary, 1—1·75 inches diameter, globose or pyriform, supported by 3 small bracts, orange or pink when ripe. Peduncles 3—1 inch long.

Occurs in the subhimalayan tract and outer hill ranges up to 3,000 feet. Common in moist localities and bordering streams. I have measured a tree at Gola Tappar in the Dehra Dun, which was 40 feet girth round the buttresses at 6 feet from the ground. Figs ripen March-April and again July-August.

5. *STREBLUS*, Lour.

Trees or shrubs. Leaves alternate, scabrid, penninerved or sub-3-nerved at base; stipules small. Flowers usually dioecious; males in pedunculate heads, axillary and from the leaf-scars; females solitary or 2—4 together, axillary, peduncled, bracteate. Male perianth-segments 4, connate at the base, imbricate; stamens 4; pistillode dilated at the top. Female perianth-segments free, imbricate, embracing the ovary; style 2-fid. Fruit with a membranous or thinly coriaceous pericarp enclosed in the fleshy perianth.

Streblus asper, *Lour.*—A small much-branched evergreen tree up to 5 feet girth and 40 feet high. Stem often short and gnarled. Bark pale bluish-grey or silvery brown, quite smooth, lenticellate, exfoliating in small thick woody scales. Blaze .3—6 inch, very fibrous, pale yellow turning a dirty orange-brown on exposure, exuding a creamy sticky juice. Twigs reddish-brown with scabrous rusty pubescence. Leaves 1.5—4 by 1—1.5 inches, rhomboid-elliptic obovate or elliptic-oblong, acute or shortly and abruptly acuminate, more or less sinuate or crenate, scabrid on both surfaces but especially beneath; lateral nerves 4—7 pairs, prominent beneath, joined by intramarginal loops. Petiole .05—1.5 inch long. Flowers dioecious, axillary. Male flowers pale yellowish-green, in globose pedunculate heads .3 inch diameter. Peduncles 1—4 together, .3—5 inch long. Female flowers solitary, inconspicuous, long-peduncled. Peduncles 1—4 together, .2—5 inch long. Fruit a 1-seeded berry, .2 inch diameter, yellow when ripe, loosely enclosed by the enlarged perianth.

Occurs along the subhimalayan tract up to 1,500 feet. Fairly common, usually in open dry miscellaneous forests. Flowers: March-April.

•LXXXIII.—JUGLANDACEÆ.

Trees, often strongly aromatic. Leaves alternate, pinnate; stipules none. Flowers unisexual, monœcious. Male flowers in pendulous catkin-like spikes; stamens 2 or more, nearly sessile, inserted on the upper surface of a bract which bears on its edge 2—6 membranous perianth-lobes. Female flowers in many- or few-flowered spikes, bracteate; calyx adnate to the 1-celled ovary, limb minutely 4-toothed; petals minute or none; ovule solitary; style short, 2-fid. Fruit a drupe or nut.

Female flowers 1—3 in a terminal spike. Fruit not attached to a wing-like bract ... 1. *Juglans*.

Female flowers in long pendulous lateral spikes. Fruit attached to a wing-like 3-lobed bract ... 2. *Engelhardtia*.

1. JUGLANS, *Linn.*

• Trees. Leaves imparipinnate. Male catkins: perianth 5-6-lobed, adnate to the inner side of the bract; stamens 10—40 in two or more rows. Female spikes short, terminal, few-flowered. Calyx cup-shaped, villous, 2-toothed at the apex. Petals 4, minute. Style short; stigmas 2. Nut often irregularly wrinkled and pitted.

***Juglans regia*, Linn.** Vern. *Karaunt* or *Akhōr*, *G. Akrōt* Gen.—Eng. Walnut.—A large deciduous tree up to 12 feet girth and 110 feet high, old stems usually irregularly fluted. Bark pale or dark grey, rough, with deep vertical furrows 1·5—3 inches apart, exfoliating in woody scales. Blaze ·75—1·25 inches, fibrous, yellowish turning orange on exposure. Young shoots tomentose. Leaves 6—15 inches long, more or less tomentose when quite young. Leaflets 5—9, rarely 13, the terminal largest, 3—8 by 1·5—4 inches, variable in shape, elliptic to oblong-lanceolate, acute or acuminate, usually entire, glabrous or pubescent along the nerves beneath, the lateral leaflets opposite or subopposite, sessile or subsessile. Male catkins lateral on the shoots of the previous year, 2—5 inches long. Female flowers 1—3, sessile, in a short terminal spike; calyx-tube ·25 inch long, obscurely 4-toothed; petals green. Drupe 1·25—1·75 inches long, globose or ovoid, pubescent, green often tinged with pink; pericarp leathery and aromatic enclosing a large 2-valved rugose nut.

Occurs throughout the hills between 5,500 and 9,000 feet. Common on the inner ranges in mixed deciduous forests of *Ulmus*, *Celtis*, *Populus*, *Acer* and *Aesculus*, usually on deep moist soils. The leaves are characteristically aromatic. Close to a temple at Waduk in North Garhwal, I have measured a stem 20 feet girth at breast height, but it was hollow. Flowers: February—April. Fruit: October–November.

2. ENGELHARDTIA, *Leschen.*

Trees. Male spikes lateral, simple or branched, erect or pendulous. Perianth connate with the simple lobed or lacinate bracts or scales. Stamens 4—12, on the bracts or scales. Female spikes pendulous. Calyx adnate to the ovary and sessile on a 3-4-lobed bract; limb 4-lobed or-toothed. Petals 0. Stigmas 2. Fruit a small globose nut adnate to the much-enlarged scarious 3-lobed reticulately-nerved bract, with midlobe exceeding the lateral.

Engelhardtia Colebrookiana, Lindl. Vern. *Gadh-mahwa*, G. *Garmālu*, A.—A small subdeciduous tree up to 7 feet girth and 40 feet high. Bark dark brown or blackish sometimes ashy in parts, somewhat rough. Branches smooth, pale grey. Blaze .75 inch, soft and fibrous, pinkish to deep claret-red. Young shoots tomentose. Leaves usually paripinnate by the abortion of the terminal leaflet, 9—15 inches long. Leaflets 3—5 pairs, opposite or subopposite, 4—8 by 1.5—3 inches, the lowest pairs often much smaller, elliptic or oblong, usually obtuse, entire, base very unequal, subcoriaceous, dark glossy green and glabrous or sparsely hairy above, softly tomentose or glabrous beneath when mature. Petioles 0—4 inch long. Rachis much swollen at the base. Male spikes 3—5 inches long, solitary or 3—5 together, arranged racemously on a rachis up to 1 inch long; perianth of 4-5 oblong scales attached to a more or less 3-lobed bract. Female spikes 2—6 inches long, pedunculate, solitary or terminating the racemes of male spikes; bracts unequally 3-lobed enclosing the base of the calyx. Fruiting spikes 4—12 inches long. Nut .2 inch diameter, globose, coriaceous; the adnate bract densely tomentose at the base.

Occurs throughout the hills between 2,000 and 7,000 feet. Very common in dry deciduous forests of the outer ranges and frequently associated with *chir*. In the commoner form the leaves are persistently hairy even when mature; the form which has leaves which are glabrous when mature has been collected in the Haldwani Division and is probably identical with *E. spicata*, Blume. Flowers: March-May. Fruit: June.

LXXXIV.—MYRICACEÆ.

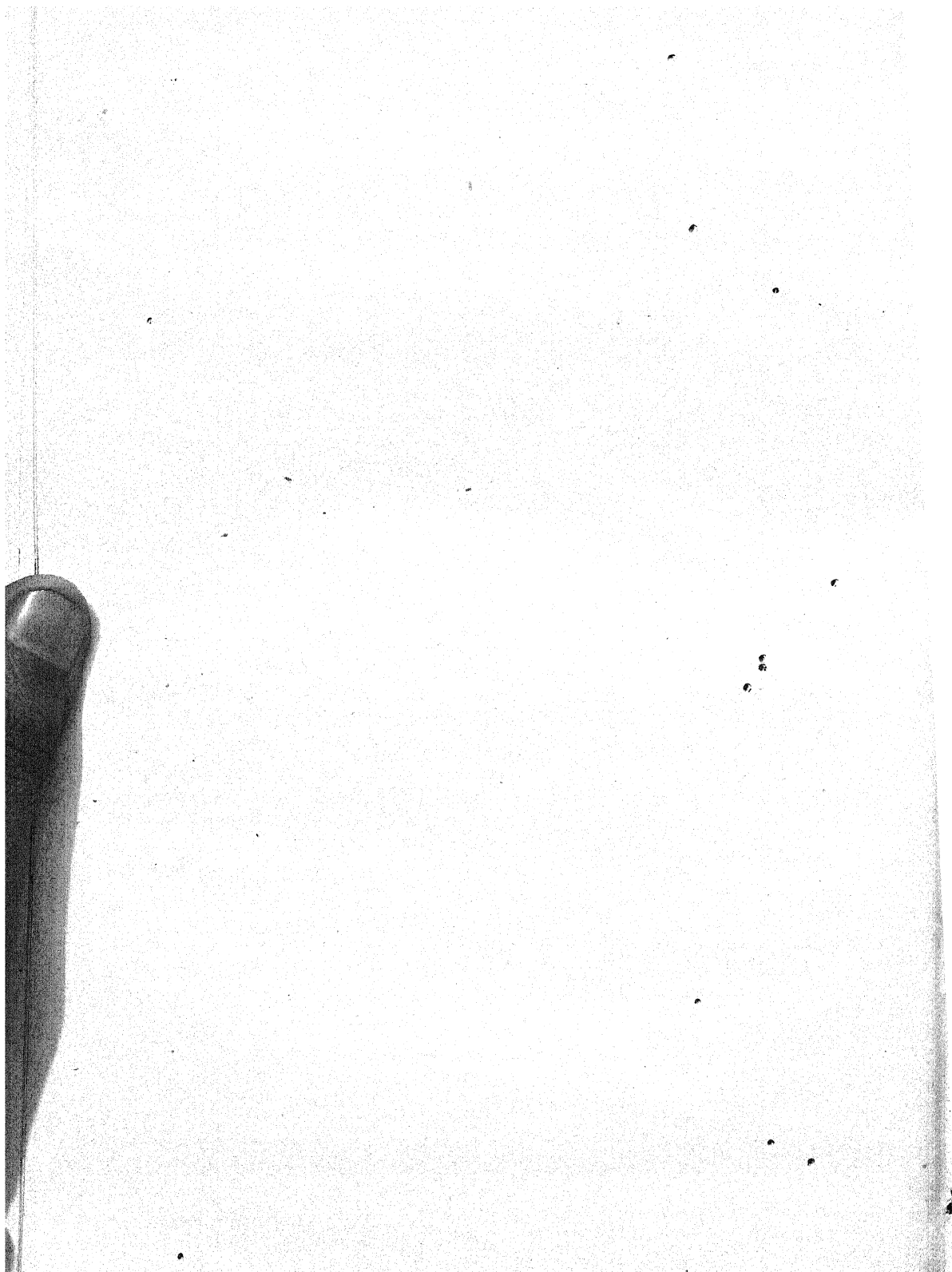
Trees or shrubs, aromatic and glandular. Leaves alternate; stipules none. Flowers unisexual, in cylindric bracteate catkin-like spikes, the male spikes sometimes fascicled or paniced, the female always solitary, occasionally a few female flowers at the top of the male spikes. Perianth none. Male flowers often surrounded by 2 or more bracts; stamens 2—16, usually 4; filaments short, free or connate. Female flowers 2—4-bracteate; ovary bicarpellary, 1-celled; ovule solitary; style 2-fid. Fruit a small, succulent, resinous or waxy drupe; endocarp hard.

MYRICA, *Linn.*

Characters of the family.

Myrica Nagi, *Thunb.* Vern. *Kāphal*, Gen.—A small evergreen tree up to 5 feet girth and 40 feet high. Bark dark brown or blackish, rather rough, exfoliating in irregular small woody scales. Blaze .6—1 inch, soft not fibrous, deep reddish-brown often with paler streaks, juice turning dark purple on the blade of a knife. Young shoots, petioles, and inflorescence brown-tomentose. Leaves 4—8 by 1.2—2 inches, oblanceolate or oblanceolate-oblong, acute, entire, undulate, base gradually narrowed, coriaceous, glabrous or nearly so when mature, dark green above, rather glossy on both surfaces, dotted beneath with minute resin dots; lateral nerves 10—16 pairs with small ones between. Petiole .2—.5 inch long. Male spikes .3—.5 inch long, arranged racemously on a common axillary stalk 1.5—4 inches long; bracts orbicular; stamens 3—6. Female spikes axillary, erect, .5—1 inch long. Drupe .4 inch long, ellipsoid, scaly, succulent, red when ripe.

Occurs throughout the hills between 5,000 and 7,000 feet. Common especially in forests of *Quercus incana*, or in mixed forests of oak and *chir*. Leaves of young plants or on coppice shoots are often serrate. Flowers: August—October. Fruit: May—June.



LXXXV.—BETULACEÆ.

Trees or shrubs. Leaves alternate, simple, deciduous. Bud-scales stipular, usually caducous. Flowers usually appearing before the leaves, dichinous and monoecious. Perianth present in flowers of only one sex, simple when present, free or connate. Male flowers in dense compound catkin-like spikes. Stamens 2—10; filaments often dividing into two, each branch bearing 1 anther-cell. Female flowers in small often minute catkins or spikes. Carpels 2. Ovary sub-inferior, after fertilisation usually more or less completely 2-3-celled, ovules 1-2 in each cell. Styles 2. Fruit usually a nut, winged or enclosed in the enlarged herbaceous bracts.

I.—Bracts of the fruiting spike forming a woody cone ... 1. *Alnus*.

II.—Bracts of the fruiting spike not forming a cone.

1. Bracts not greatly enlarged in fruit. Nut with 2 small membranous wings ... 2. *Betula*.

2. Bracts greatly enlarged in fruit.

(a) Nut small, adnate to the base of a large reticulate wing-like bract ... 3. *Carpinus*.

(b) Nut rather large, enclosed in a sheathing bracteole ... 4. *Corylus*.

1. ALNUS, Linn. (*The Alders*.)

Deciduous trees. Male flowers in pendulous catkins; bracts 3-flowered, with usually 4 bracteoles adnate to each bract; perianth-segments 4; stamens 4, opposite to the segments, anthers sub-sessile. Female flowers in short erect spikes; ovaries 2 in the axil of each bract, each with 2 bracteoles, 2-celled; ovules 1 in each cell. Fruiting spike a small woody cone composed of the persistent bracts between which are the small 1-seeded nuts; nuts narrowly winged or margined.

***Alnus nepalensis*, D. Don.** Vern. *Utis*, Gen. *Ust*, NG.—A large deciduous or subdeciduous tree up to 11 feet girth and 95 feet high. Bark of poles smooth, green or grey, often with yellowish patches and short raised horizontal lenticels; of old stems rough, dark brown, often with pale ashy patches. Blaze 1—1.5 inches, pinkish or reddish-brown, containing numerous sclerotic pieces. Young shoots usually pubescent. Leaves 4—6 by 2—4 inches, elliptic, apex rounded acute or abruptly short-acuminate, entire or sinuate, rarely serrulate, base rounded or narrowed, pubescent along the nerves beneath when young, usually glaucescent and with minute resinous dots; lateral nerves 6—15 pairs, curving upwards and anastomosing within the margin. Petiole 4—7

inch long. Male catkins 5—10 inches long, in large terminal panicles. Female spikes 3 inch long, in axillary racemes of 5-6, rarely solitary. Cones 5—8 inch long, apparently in panicles owing to the fall of the leaves.

Occurs throughout the hills between 4,000 and 9,000 feet. Very common. Sometimes found growing sporadically on the driest southern aspects but more usually on boulder or shingle beds bordering large streams, and in such situations it often forms gregarious patches. Flowers: October-November.

Alnus nitida, Endl. is found to the west of our area and has been planted near Almora. It differs from *A. nepalensis* in the shape of the leaves which are narrowed from about the middle to the apex, moreover the lateral nerves or their branches run to the margin of the leaf instead of anastomosing within the margin.

2. BETULA, Linn. (*The Birches*.)

Deciduous shrubs or trees; bark peeling off in thin papery strips at least on young stems. Leaves serrate. Male flowers in pendulous catkins; bracts peltate with usually 3 bibracteolate flowers; perianth-segments 2—4; stamens 2; filaments forked, separating the anther-cells. Female flowers in erect or pendulous spikes; bracts imbricate; bracteoles 2, adnate to the bract which thus appears 3-lobed; ovary 2-celled, compressed, usually 3 ovaries in the axil of each 3-lobed bract; ovules 1 in each cell. Fruiting spike of deciduous 3-lobed scales and winged or margined nuts.

Lateral nerves 7—9 pairs. When young petioles silky
and leaves sticky, the former soon becoming glabrous.
Female spikes solitary 1. *utilis*.

Lateral nerves 9—12 pairs. When young petioles and
midrib tomentose. Female spikes usually in clusters
of 2-3 2. *alnoides*.

1. *Betula utilis*, D. Don. Vern. *Bhūj*, Gen. *Bhōj-pattar*, A.—
A small deciduous tree up to 8 feet girth and 65 feet high. Bark white or silvery grey with conspicuous long horizontal lenticels, peeling off in papery layers. Twigs dotted with yellow resinous drops. Young shoots, petioles and leaves silky, soon becoming glabrous. Leaves 2—4 inches long, ovate, acute, sharply and irregularly serrate, base broadly cuneate or rounded rarely subcordate, sticky when young with yellow resinous scales; lateral nerves 7—9 pairs. Petiole 4—8 inch long. Male catkins 2-3 inches long collected towards the tips of the longer shoots. Female spikes about 1 inch long, solitary, erect, terminating dwarf shoots. Fruiting spikes not exceeding 1.5 inches long; bracts deeply 3-lobed; lobes linear-oblong; fruit narrower than the bracts, the wings narrower than the nut.

Occurs along the main Himalayan range between 9,500 and 13,500 feet. Abundant and gregarious, forming tree forest at higher elevations than any other species within our area. Flowers: May, with the young leaves. Fruit: October-November.

2. *Betula alnoides*, Buch.-Ham. Vern. *Saur*, Gen.—A large deciduous tree up to 12 feet girth and 100 feet high. Bark of stems up to about 5 feet girth usually silvery grey, peeling off in horizontal papery strips and with numerous dark horizontal lenticels often several inches long, in old stems becoming rough and brown. Blaze 1 inch, hard, partly reddish-brown and partly yellowish-brown. Twigs not resinous, tomentose when young. Petioles, midrib and main nerves beneath tomentose ultimately becoming glabrous. Leaves 3—5 inches long, ovate or ovate-lanceolate, acuminate, unequally doubly or trebly usually cuspidately serrate, base rounded or subcordate, when mature glabrous except along the nerves beneath, dotted on the undersurface with minute inconspicuous resinous scales, lateral nerves 9—12 pairs. Petiole 3—6 inch long, tomentose when young, afterwards pubescent. Male catkins 2—7 inches long, from the tips of the longer shoots. Female spikes about 2 inches long, 2-3 together, rarely solitary, pendulous, terminating dwarf shoots. Fruiting spikes often 3 inches long; bracts 3-lobed; fruit broader than the bracts, the wings broader than the nut.

Occurs throughout the hills between 5,500 and 9,000 feet. Common in the central and inner ranges but not gregarious. Often associated with *Quercus dilatata* and usually along the banks of streams and in boulder-strewn ravines. Flowers: March-April, before the new leaves.

: 3. CARPINUS, Linn. (*The Hornbeams*.)

Deciduous trees. Leaves serrate. Male flowers in lateral pendulous catkins; bracts ovate; bracteoles 0; stamens 3-4 on a hairy torus adnate to the bract; filaments 2-fid separating the anther-cells. Female flowers in drooping terminal spikes; bracts foliaceous; bracteoles 2; perianth-limb minute, superior, toothed; ovary 2-celled; ovules 1 in each cell. Nut 1-seeded, 6—12-ribbed, enclosed in the base of the enlarged foliaceous bract and bracteoles which form a reticulate wing to the fruit.

Shoots and petioles glabrous. Petioles 3—6 inch long.

Mature leaves glabrous. Lateral nerves 10—13 pairs 1. *viminea*.

Shoots and petioles tomentose. Petioles 1.2 inch long.

Mature leaves more or less hairy. Lateral nerves 13—17 pairs 2. *faginea*.

1. *Carpinus viminea*, Lindl. Vern. *Pomni* or *Gaura*, G.—A medium-sized deciduous tree up to 8 feet girth and 70 feet high, the stem irregularly and often deeply fluted. Bark pale ashy brown or grey sometimes whitish in parts, fairly smooth. Blaze .25—.35 inch, hard, pale yellowish or olive-brown. Young shoots glabrous. Leaves 3—6 by 1.25 inches, ovate-lanceolate sometimes ovate or lanceolate, caudate-acuminate, sharply biserrate except the tail which is simply serrate, glabrous except when quite young, thinly coriaceous, slightly

glossy above but more so beneath; lateral nerves 10—13 pairs, prominent beneath. Petiole .3—.6 inch long; slender, glabrous or nearly so. Male catkins 1.2.5 inches long; rachis silky. Female catkins less than 1 inch long, silky. Fruiting spikes 2-3 inches long; bract lanceolate, unequal-sided, the narrower side entire or subentire, the broader coarsely toothed, usually with two small lobes one on each side near the base which bring the greatest width of the bract well below the middle. Nut .15 inch long, glandular.

Occurs throughout the hills between 5,000 and 8,000 feet. Very common almost throughout its range, chiefly in moist shady situations in forests of *Quercus incana* or *Q. dilatata*. The leaves turn yellow as they fall. Flowers: March-April. Fruit: October-November.

2. *Carpinus faginea*, Lindl. Vern. *Pomni* or *Katui* G.—A small or medium-sized deciduous tree up to 6 feet girth and 50 feet high, the stem irregularly fluted. Bark dark brown or blackish and slightly rough in parts, silvery grey and smooth in other parts. Blaze .25—.35 inch, hard, reddish-or pinkish-brown. Young shoots and twigs tomentose. Leaves 2.5—5 by 1.2.25 inches, ovate-oblong, acuminate, sharply serrate, the teeth nearly equal, very silky beneath when young, persistently hairy on the nerves; lateral nerves 13—17 pairs, prominent beneath. Petiole .1-.2 inch long, silky-tomentose. Male catkins 1—1.5 inches long; rachis silky. Female catkins less than 1 inch long, silky. Fruiting spikes 2-3 inches long; bract unequal-sided, one side semi-elliptic or ovate toothed, the other narrow entire, the greatest width at or near the middle. Nut .15 inch long, glandular.

Occurs throughout the hills between 4,000 and 6,500 feet, but rare on the outer ranges. Common on the inner ranges where it is sometimes found growing side by side with *C. viminea*. It has a tendency to gregariousness. Flowers: March-April, Fruit: October-November.

4. *CORYLUS*, Linn. (*The Hazels*.)

Deciduous trees or shrubs. Leaves serrate, in bud folded parallel to the midrib. Male flowers in bracteate pendulous catkins, catkins fasciculate or 2-3 on a common peduncle; stamens 4—8, filaments forked separating the anther-cells which bear a tuft of hairs at the tip. Female flowers in pairs in the upper bracts of a minute few-flowered many-bracteate spike or head, bracteole solitary 3-partite; perianth superior, limb annular, toothed; ovary 2-celled; ovules 1 in each cell. Nut woody or bony, enclosed in the enlarged herbaceous bracts which form a cup.

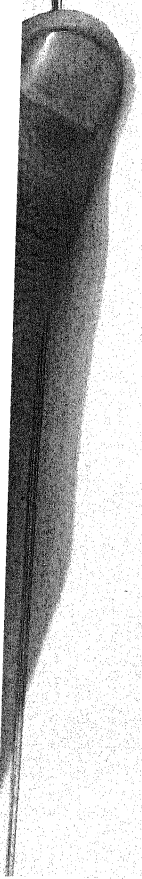
***Corylus Jacquemontii*, Dcne.** Syn. *Corylus Colurna*, Linn. Vern. *Kabāsi*, NG.—A small or medium-sized deciduous tree up to 7 feet girth and 70 feet high. Bark very pale brown or grey, rough, divided by shallow cracks into small rectangular scales or long thin woody strips. Blaze .3—.35 inch, not or slightly fibrous, pinkish usually with

a few narrow darker streaks. Young parts glandular-hairy. Leaves 3—7·5 by 2·5-6 inches, ovate or obovate, acuminate, irregularly and sharply lobulate and toothed, base cordate, thin, membranous, silky pubescent on the nerves especially beneath when young, glabrous except in the axils of the nerves beneath when mature; lateral nerves 10—12 pairs, the lowest pair basal. Petiole 1-2 inches long. Flowers appearing before the leaves. Male catkins 2-3 inches long, arranged in short racemes of about 4—6. Female flowers minute, in small sessile bud-like spikes composed of numerous imbricate bracts, the flowers in pairs in the axils of a few of the uppermost bracts. Fruit a nut, 5—7 inch long, sheathed by the much enlarged lobed and toothed glandular-hairy bracteole and supported by the large laciniate bracts.

Occurs along the main Himalayan range between 7,000 and 9,000 feet. Common in mixed deciduous forest with maples, horsechestnut, etc., also in spruce forests, rarely forming pure crops. When the main stem dies from decay or other cause one or more strong shoots from near the ground are produced so that it is common to find clumps of several stems from a common rootstock. Flowers: April-May.

12

12-1-12



• LXXXVI.—FAGACEÆ.

Trees or shrubs. Leaves alternate, simple, evergreen. Bud-scales stipular, usually caducous. Flowers and leaves appearing together, or flowers appearing after the leaves, usually diclinous and monœcious, rarely hermaphrodite. Flowers of both sexes with perianth of 4—7 connate segments. Male flowers in slender interrupted simple or compound catkin-like spikes. Stamens 4—14. Female flowers 1—3 together, surrounded by an involucre of free or connate bracts. Carpels usually 3-4, rarely six. Ovary sub-inferior, after fertilisation usually more or less completely 2-3-celled; ovules 1-2 in each cell. Styles 3-4. Fruit of 1 or more nuts surrounded by an involucre; involucre cup-shaped or completely enclosing the nuts.

I.—Involucre forming a cup. Bracteoles not spinous
• or tubercular ... 1. *Quercus*.

II.—Involucre completely surrounding the nut. Bracteoles spinous or tubercular ... 2. *Castanopsis*.

• 1. QUERCUS, Linn. (*The Oaks*.)

Trees or shrubs. Flowers monœcious. Male flowers in pendulous catkins; bracts small, 1-flowered; perianth campanulate, 4—8-lobed or partite; stamens usually 6—12; filaments slender; pistillode usually 0. Female flowers with an involucre of small scales, solitary and axillary or in few-flowered spikes; perianth-tube adnate to the ovary, limb minutely lobed or toothed; staminodes minute or 0; ovary 3-celled; ovules 2 in each cell; styles 3. Fruit (acorn) a 1-seeded nut seated on a cup formed from the enlarged and hardened involucreal scales.

I.—Mature leaves clothed with white or whitish tomentum beneath.

1. Lateral nerves 9—13 pairs. Stipules broad at the base ... 1. *lanuginosa*.
2. Lateral nerves 12—20 pairs. Stipules narrowed at the base to a stalk ... 2. *incana*.

II.—Mature leaves glabrous beneath or if hairy not white-tomentose.

1. Leaves glaucous beneath. Petiole 4—1 inch long ... 3. *glauca*.
2. Leaves not glaucous beneath. Petiole 0—3 inch long.
- (a) Young shoots clothed with brown not stellate tomentum. Acorn subglobose ... 4. *semecarpifolia*.
- (b) Young shoots clothed with stellate pubescence. Acorn ovoid ... 5. *dilatata*.

1. *Quercus lanuginosa*, Don. Vern. *Riānj*, A and NT. *Sānj*, SG.—A large evergreen tree up to 10 feet girth and 80 feet high, usually branched low down. Bark pale grey or ashy-brown, lenticellate, rather rough, exfoliating in large irregular thin woody plates which remain long in a semidetached condition. Blaze .5—.75 inch, rather hard, fibrous, pink or bright reddish in the outer half usually white or pale yellowish in the inner half rapidly turning orange on exposure. Young parts densely tawny-woolly or tomentose, persistent on the lower leaf-surface. Leaves 4—8 by 1.5—3.5 inches, oblong-or elliptic-lanceolate, acute or acuminate, cuspidate-serrate, coriaceous, dark glossy green with distinct pale midrib and glabrous above, with dense pale yellow or greenish-white tomentum and prominent secondary and tertiary nerves beneath; lateral nerves 9—13 pairs, straight, parallel. Petiole .3—1 inch long. Stipules .3-.4 inch long, ovate-oblong, broad at the base, caducous. Male catkins 2—5 inches long, woolly, usually interrupted. Female flowers solitary or in pairs. Acorns .8 inch long, one-third to one-half enclosed by the campanulate cup when ripe.

Occurs throughout the hills between 6,000 and 8,000 feet. Not uncommon in the Almora District, but scarce in Garhwal. Often found pure, but also frequently associated with *Quercus incana*. Flowers: April, with the new leaves.

2. *Quercus incana*, Roxb. Vern. *Bānj*, Gen.—A large evergreen tree up to 15 feet girth and 100 feet high. Bark pale grey to blackish, rough, exfoliating in thick irregular woody scales. Blaze .5—1 inch, rather soft, fibrous, pink. Young parts clothed with soft silvery-grey tomentum, often tinged pink. Leaves 3—6 by 1-2 inches, oblong-or ovate-lanceolate, acuminate, cuspidate-serrate, coriaceous, dark green and glabrous above, densely white-or grey-tomentose with prominent secondary nerves beneath; lateral nerves 12—20 pairs, straight, parallel. Petiole .4—6 inch long. Stipules .3-.4 inch long, oblanceolate, base narrowed to a stalk, caducous. Male catkins 2—4 inches long, slender, pubescent, usually interrupted. Female flowers solitary or clustered in the leaf-axils on short stout peduncles. Acorn .8 inch long, one-third to one-half enclosed by the campanulate cup when ripe.

Occurs throughout the hills between 4,000 and 8,500 feet, and in the Mandal valley near Ratwadhab in the Kalagarh Division is found growing at 1,500 feet elevation, though there is some doubt about its being entirely natural in this locality. Abundant and very gregarious, forming extensive pure or nearly pure forests. Flowers: April-May. Fruit: December—February.

3. *Quercus glauca*, Thunb. Vern. *Phaniāt* or *Phaniānt*, Gen. *Harinj*, NG.—A medium-sized or large evergreen tree up to 13 feet girth and 85 feet high. Bark dark brown, grey or blackish, rough to the touch but not fissured, lenticellate. Blaze .4—1 inch, hard with scattered woody pieces, the innermost layer fibrous, pinkish-or reddish-

brown sometimes with paler bands. Young shoots glabrous. Leaves 3·5—7 by 1·5—3 inches, oblong oblong-lanceolate or oblanceolate, acuminate, cuspidate-serrate except towards the base, coriaceous, glabrous and shining above, glaucous and pubescent beneath or ultimately glabrescent; lateral nerves 10—14 pairs, straight, parallel. Petiole 4—1 inch long. Stipules 3—6 inch long, linear or linear-oblanceolate, caducous. Male catkins 2-3 inches long, bracts much longer than the flowers. Female flowers 2-3 together on a short axillary peduncle. Acorns 6-7 inch long, solitary or in pairs; the cup sessile, composed of tomentose scales arranged in 5—7 annular belts, covering the base of the nut only.

Occurs throughout the hills between 3,000 and 6,500 feet. Common in moist depressions and along the banks of streams, especially in cool shady ravines intersecting *chir* forest, not gregarious. The young immature leaves are glossy and tinged with shades of pink or purplish-brown. Flowers: March-April. Fruit: October-December.

4. *Quercus semecarpifolia*, Smith. Vern. *Karshu* or *Kharu*, Gen.—A large evergreen or subdeciduous tree up to 12 feet girth and 100 feet high. Bark silvery grey to blackish, rough, with shallow cracks, exfoliating in irregular woody scales. Blaze 4—1 inch, somewhat coarsely fibrous and with scattered hard woody specks, pink slowly turning brownish on exposure. Young shoots tomentose. Leaves 2—5 by 1—3 inches, elliptic or elliptic-oblong, usually entire sometimes more or less spinous-toothed on young trees and occasionally also on old trees, apex usually obtuse and rounded, sometimes mucronate, rarely acute, rigidly coriaceous, glabrous and glossy dark green with pale midrib above, rusty-tomentose or glabrescent beneath; lateral nerves 8—12 pairs, prominent beneath, forked within the margin. Petiole 0—2 inch long. Male catkins 2—6 inches long, softly pubescent. Female flowers in few-flowered short spikes. Acorn 75—1 inch diameter, subglobose, cup covering only the base of the nut.

Occurs throughout the hills between 7,000 and 11,500 feet. Abundant and very gregarious. On the southern slopes of the main Himalayan range this species often forms the limit of tree growth. It is often associated with *Abies Pindrow*, Spach. The acorn germinates immediately on falling. Flowers: May-June. Fruit: June—August.

5. *Quercus dilatata*, Lindl. Vern. *Telunj* or *Moru*, G. *Tilōnj*, A.—A large evergreen tree. Bark dark grey or dark reddish-brown, rough with shallow cracks, exfoliating in irregular woody scales. Quite young shoots and petioles with flocculent stellate pubescence. Leaves usually 2—4 by 1-2 inches, oblong-lanceolate or elliptic, entire or cuspidate-serrate especially on young trees, acute, mucronate, coriaceous, rather dark shining green and glabrous on both sides; lateral nerves 8—12 pairs, mostly forked. Petiole 1—3 inch long. Male catkins 2-3 inches long, much interrupted. Female flowers in short axillary

spikes. Acorns about 1 inch long, ovoid, one-third immersed in the hard cup.

Occurs throughout the hills between 6,000 and 9,000 feet. Abundant and usually gregarious preferring deep soils and northern aspects, frequent on limestone. I have measured an apparently sound stem of 16 feet girth. Flowers: April-May. Fruit: August—October.

2. CASTANOPSIS, *Spach.*

Trees, rarely shrubs. Leaves entire, toothed or lobed. Spikes usually unisexual, rarely androgynous. Male spikes erect. Perianth 5-6-lobed or-partite, lobes connate, campanulate. Stamens usually 10—12; filaments slender. Pistillode small, hairy. Female spikes erect, bracts involucre. Perianth-segments connate, urceolate, enclosed in imbricate bracts; limb very shortly 6-lobed. Ovary after fertilisation 3-celled; ovules 2 in each cell; styles usually 3. Fruit of 1—4 nuts, covered by the closed fruiting involucre, beset with clusters of spines or tubercles, often irregularly dehiscent.

***Castanopsis tribuloides*, A. DC.** Vern. *Katōnj*, G. *Katūnj*, A.—A small or medium-sized evergreen tree. Bark dark brown, rough. Blaze 5 inch, orange-or pinkish-brown. Leaves 4—9 by 1·2·5 inches, lanceolate or oblong-lanceolate, long-acuminate, entire, undulate, base cuneate and often unequal, thinly coriaceous, silky hairy when young, glabrous when mature, glossy on both surfaces; lateral nerves 10—14 pairs, slender, curved upwards within the margin. Petiole 2—6 inch long. Male flowers in tomentose interrupted catkins 2·5—5 inches long arranged racemously on terminal leafless shoots 2—4 inches long. Female flowers in interrupted tomentose spikes 2—5 inches long which are either axillary and solitary or several together towards the top of the leafless shoots above the male catkins. Nut solitary, about 4 inch long, resembling an acorn, completely invested by a coriaceous involucre; involucre finely tomentose and covered with substellate spines up to 3 inch long; fruit including spines 5—75 inch diameter.

Occurs throughout the hills between 3,000 and 6,500 feet. Rather scarce, becoming scarcer westwards and has not been recorded from South Garhwal. Usually associated with *banj*. Flowers: July—December: Fruit: August—October.

LXXXVII.—SALICACEÆ.

Deciduous trees or shrubs. Leaves alternate, simple. Flowers dioecious or exceptionally monoecious, both sexes in catkins consisting of bracts each with one flower in the axil; bracteoles 0. Perianth 0. Disk of one or more glands or cup-shaped. Male flowers; stamens 2 or more, filaments usually free; pistillode 0. Female flowers; ovary of 2, rarely 3, connate carpels, 1-celled; ovules few or many on 2—4 placentae; style short or 0; stigma notched or lobed. Fruit an ovoid or lanceolate 2—4-valved capsule. Seed minute, enveloped in a mass of silky hairs attached to the funicle.

Petioles short. Disk of 1-2 glands	...	...	1. <i>Salix</i> .
Petioles long. Disk flat or cupshaped	...	...	2. <i>Populus</i> .

1. SALIX, Linn. (*The Willows*.)

Trees or shrubs. Leaves alternate, very rarely opposite. Disk usually of 1-2 glands. Stamens 1—12, usually 2; filaments free or connate at the base or united up to the anthers. Ovary sessile or stipitate. Capsule 2-valved, the valves usually recurved when ripe.

I.—Trees or large shrubs usually with a single stem.

A. Stamens 3-12.

- | | | | |
|--|-----|-----|-------------------------|
| 1. Leaves .6—1.75 inches broad. Male catkins 2—5 inches long | ... | ... | 1. <i>tetrasperma</i> . |
| 2. Leaves .3—.8 inch broad. Male catkins 1-2 inches long | ... | ... | 2. <i>acmophylla</i> . |

B. Stamens 2.

- | | | | |
|---|-----|-----|-------------------------|
| 1. Filaments connate at least half way up. Capsules pubescent | ... | ... | 3. <i>oxycarpa</i> . |
| 2. Filaments free. | | | |
| (a) Capsules pubescent | ... | ... | 4. <i>Wallichiana</i> . |
| (b) Capsules glabrous | ... | ... | 5. <i>daphnoides</i> . |

II.—Medium-sized shrubs, usually 4—8 feet high, with many stems from close to the ground.

- | | | | |
|--|-----|-----|---------------------|
| 1. Leaves .4—1 inch broad. Male catkins on short leafy shoots | ... | ... | 6. <i>elegans</i> . |
| 2. Leaves 1.2-2.5 inches broad. Male catkins with a few small leaves at the base | ... | ... | 7. <i>hastata</i> . |

III.—Small erect shrubs seldom exceeding 2 feet high.

Leaves not exceeding 1.5 inches long.

- | | | | |
|--|-----|-----|--------------------------|
| 1. Leaves and capsules quite glabrous | ... | ... | 8. <i>furcata</i> . |
| 2. Leaves never quite glabrous. Capsules hairy | ... | ... | 9. <i>sclerophylla</i> . |

IV.—Stem prostrate and creeping, sending up short annual deciduous shoots.

... 10. *Lindleyana*.

I have not included *S. flabellaris*, Anders as there appear to be no records of its occurrence east of the Nila valley in Tehri Garhwal. This species has most of the characteristics of *S. furcata* from which it is perhaps best distinguished by a longer petiole which is .2-.3 inch long.

1. *Salix tetrasperma*, Roxb. Vern. *Bhains* or *Gadh-bhains*, Gen.—A medium-sized deciduous tree up to 9 feet girth and 60 feet high. Bark pale or dark brown, very rough and hard with deep and broad vertical furrows usually 2-3 inches apart. Blaze .4—1.2 inches, very fibrous, pink, the juice turning dark purple on the blade of a knife. Young shoots silky. Leaves 2.5—5 by .6—1.75 inches, lanceolate or ovate-lanceolate, caudate-acuminate, entire or more usually serrulate, dark green and glabrous above with pale midrib, pale or whitish beneath and more or less silky when quite young. Petiole .2—7 inch long. Flowers appearing after the leaves. Male catkins 2—5 inches long, sweet-scented, sessile or on leafy shoots; rachis hairy; bracts concave, villous. Stamens 5—10; filaments free, woolly towards the base. Disk of 2 glands. Female catkins 1—4 inches long, on leafy shoots; rachis hairy; bracts as in the male but smaller. Fruiting catkins 2—4 inches long; capsules .15—.2 inch long, glabrous, stipitate.

Occurs throughout the subhimalayan tract and central and outer hill ranges up to 3,500 feet. Common below the hills, usually along the banks of streams and in swampy localities. Flowers: September-October. Fruit: November-December.

2. *Salix acmophylla*, Boiss. Vern. *Bhains* or *Gadh-bhains*, Gen.—A small deciduous tree. Bark rough with irregular mainly vertical cracks. Twigs slightly hairy when quite young. Leaves 3—6 by .3—8 inch, linear-lanceolate, caudate-acuminate, serrulate or more usually entire, silky when quite young, glabrous on both surfaces and glaucous beneath when mature. Petiole .1—.4 inch long. Flowers appearing after the leaves. Male catkins 1-2 inches long on short leafy shoots; rachis villous; bracts concave, very villous. Stamens 4—6; filaments free, woolly towards the base. Disk of 2 glands. Female catkins .75—1.5 inches long, on short leafy shoots; rachis villous; bracts as in the male. Fruiting catkins 1-2 inches long; capsules about .2 inch long, glabrous, stipitate.

Probably occurs throughout the central and outer hill ranges between 1,500 and 5,500 feet, but I have seen very few specimens from our area. Usually on the banks of streams. Flowers: February-March. Fruit: March-April.

3. *Salix oxycarpa*, Anders.—A large deciduous shrub or small tree. Young shoots somewhat hoary. Leaves 2—4 by .75—1.5 inches, elliptic-oblong, acute or subacuminate, base rounded or acute, serrulate or subentire, sparsely silky when young, glabrous or with hairy midrib when mature, pale and glaucous beneath. Petiole .1—.3 inch long. Flowers appearing with the leaves. Male catkins 1-2 inches long, dense, subsessile, with a few small leaves at the base; rachis silky; bracts dark brown, silky. Stamens 2; filaments connate to half their length or throughout, glabrous. Disk of one gland. Female catkins on short lateral shoots;

rachis and bracts as in the male. Fruiting catkins 2—3·5 inches long; capsules ·25 inch long, silky-pubescent, stipitate.

This species has been collected near Pandukeshwar in North Garhwal at 7,700 feet elevation, *vide* my specimen no. 813 in the Herbarium at Dehra Dun. It is liable to be mistaken for *S. Wallichiana*. Flowers: April-May.

4. *Salix Wallichiana*, Anders. Vern. *Bhains* or *Gadh-bhains*.

Gen.—A deciduous shrub or small tree. Twigs silky-tomentose. Leaves 2—4 by ·6—1·2 inches, sometimes larger, ovate-lanceolate or oblong-lanceolate, entire or obscurely glandular-serrate, silky on both surfaces when young, nearly glabrous when mature and glaucous beneath or persistently silky on both sides. Petiole ·2—·4 inch long. Flowers before or sometimes with the leaves. Male catkins 1—1·5 inches long, nearly sessile with a few leaves at the base, dense; rachis villous; bracts densely silky on both sides. Stamens 2; filaments free, villous towards the base. Disk of 1 gland. Female catkins 2-3 inches long, on very short leafy shoots, ascending, flexuose; rachis villous; bracts smaller than in the male, silky. Fruiting catkins 1·5—5 inches long; capsules densely silky or glabrescent, sessile or shortly stipitate, ·25 inch long.

Occurs throughout the central and inner ranges between 6,000 and 10,500 feet, and if my specimen no. 669 collected near Malari has been correctly identified it is found here up to 12,500 feet. It is a variable species of which several varieties have been described. It appears to be fairly common on the inner ranges. Flowers: March—June. Fruit: May—July.

5. *Salix daphnoides*, Villars. Vern. *Bhains*, Gen.—A large

deciduous shrub or small tree up to 5 feet girth and 40 feet high. Bark smooth when young, rather deeply furrowed on old stems. Blaze ·25 inch, pink. Young shoots pubescent. Leaves 2—5 by ·7—2 inches, lanceolate elliptic or ovate-lanceolate, usually serrate and often rather coarsely so with gland-tipped teeth, when mature puberulous on the midrib above, glabrous pale and glaucous beneath. Petiole ·3—·6 inch long, pubescent. Flowers before the leaves. Male catkins 1—1·5 inches long, nearly sessile with a few small leaves at the base, dense; rachis villous; bracts silky on both sides or glabrate on the back. Stamens 2; filaments free, glabrous. Disk of one gland. Female catkins 2—4 inches long, on very short usually leafy shoots; rachis villous; bracts as in the male. Fruiting catkins 4—7 inches long; capsules ·2—·25 inch long, glabrous, subsessile.

Occurs throughout the hills between 5,500 and 10,000 feet. Common in open oak forests. Flowers: March—May. Fruit: June-July.

6. *Salix elegans*, Wall. Vern. *Bhotiāna* or *Bōgchia*, NG.—A

deciduous shrub usually 5—10 feet high, but sometimes up to 15 feet with stems up to 3 inches diameter. Usually branching freely from near the ground, the stems often much curved at the base. Bark pale

grey, smooth or roughish on old stems. Blaze .25 inch, pink sometimes streaked with white. Twigs reddish-brown. Young shoots pubescent. Leaves 1.2-1.75 by .4—1 inch, elliptic oblong or obovate, serrulate, glabrous or more or less pubescent when young, glabrous and very glaucous beneath when mature. Petiole .1—3 inch long. Flowers after the leaves, catkins often androgynous. Male catkins 1-2 inches long, on short leafy shoots, dense; rachis villous; bracts ciliate. Stamens 2; filaments very villous in the lower half, free or united by the hairs. Disk of one gland. Female catkins 1.5—4 inches long, on leafy shoots, slender; rachis villous; bracts as in the male. Fruiting catkins 1.5—5 inches long; capsules .15 inch long, glabrous, very shortly stipitate.

Occurs throughout the hills between 7,000 and 12,000 feet. Very common on the central and inner ranges, often gregarious in openings in the forest canopy. Along the Dhauli valley in North Garhwal it is commonly associated with blue pine. The leaves turn yellow as they fall. Flowers: March-April. Fruit: June-July.

7. *Salix hastata*, Linn.—A deciduous shrub usually 4—6 feet high but sometimes up to 12 feet with stems 2 inches diameter. Usually branched from near the ground, the stems often much curved at the base. Bark quite smooth, ashy or pale grey. Twigs orange-or reddish-brown. Young shoots glabrous or silky-hairy. Leaves 2—4 by 1.2-2.25 inches, usually ovate or elliptic, serrate with gland-tipped teeth, clothed when young with loose tangled silky hairs, glabrous or hairy only on the midrib above when mature, glaucescent beneath. Petiole .3—6 inch long. Flowers with the leaves. Male catkins 1-2 inches long, sessile with a few small leaves at the base, dense; rachis densely silky; bracts more or less densely silky, black or blackish towards the tips. Stamens 2; filaments free or not infrequently united wholly or in part, glabrous. Disk of one gland. Female catkins 1-2 inches long, sessile with a few small leaves at the base; rachis silky; bracts as in the male, but longer. Fruiting catkins 2—5 inches long; capsules glabrous, .2—2.5 inch long, stipitate.

Occurs on the main Himalayan range between 10,000 and 13,500 feet. It is usually found growing above tree level with *Rhododendron* and other shrubs, and it sometimes forms small gregarious patches. Flowers: May—July. Fruit: July-August.

8. *Salix furcata*, Anders. Syn. *S. fruticosa*, Anders. *ex parte*.—An erect deciduous shrub 1-2 feet high with stiff much-branched stems up to .75 inch diameter. Bark smooth, pale brown. Young shoots pubescent or tomentose. Leaves .75—1.5 by .4—8 inch, elliptic-oblong or obovate, obtuse rarely acute, usually serrulate in the upper half sometimes almost entire, base acute or rounded, glabrous, somewhat glaucous beneath. Petiole .05—1 inch long. Flowers with the immature young leaves on short leafy shoots. Male catkins .5—1 inch long, erect, dense; rachis densely silky; bracts dark red or reddish,

glabrous. Stamens 2; filaments free, hairy at the base. Female catkins .5—1 inch long, erect; rachis densely silky, bracts as in the male. Fruiting catkins 2—4 inches long; capsules .15 inch long, glabrous, sessile.

Occurs along the main Himalayan range between 10,000 and 13,000 feet. Fairly common on steep open rocky or grassy slopes above tree forest, sometimes forming gregarious patches. The leaves turn yellow before falling. Flowers: May-June. Fruit: October.

9. *Salix sclerophylla*, Anders.—An erect bushy deciduous shrub usually 1-2 feet high but up to 4 feet with stiffly branched stems up to 2 inches diameter. Bark fairly smooth, pinkish-or yellowish-brown. Young shoots rather thinly clothed with a loose white tomentum. Leaves .5—1 by .3—.5 inch, elliptic-oblong or ovate, acute, entire, base rounded or sub-truncate, more or less tomentose on both surfaces when young, dark green and glabrescent above, pale and silky pubescent beneath when mature. Petiole .1-.2 inch long. Flowers before or with the young leaves, the catkins appearing on the old wood below the current year's shoots. Male catkins .3—.5 inch long, dense-flowered, erect; stamens 2; bracts hairy. Fruiting catkins .3—.5 inch long; capsules .15 inch long, sessile, pubescent.

Occurs on the dry interior ranges bordering Tibet between 13,000 and 14,000 feet. At Rimkim in North Garhwal I found it growing gregariously over quite a large area of flat shingle and boulder-strewn ground bordering a stream. It also grew here on north slopes, but was kept browsed down by sheep to a height of only 2-3 inches. Flowers: June-July. Fruit: July-August.

10. *Salix Lindleyana*, Wall.—A small deciduous shrub with procumbent creeping stems often several feet long and up to 1 inch diameter; the stems producing annual deciduous erect side-shoots usually 1—4 inches long which may be flower-bearing or not. Bark pale reddish-brown. Young shoots glabrous. Leaves .3—.8 by .15—.3 inch, elliptic-oblong or oblong-lanceolate, entire, serrulate or crenulate, glabrous, glaucous beneath, base narrowed into the petiole. Petiole .05—.15 inch long. Flowers after the leaves, terminating the lateral leafy shoots. Male catkins .3—.5 inch long, few-flowered, erect; rachis glabrous; bracts green, glabrous. Stamens 2; filaments free, glabrous. Disk of 2 glands. Female catkins similar to the male. Fruiting catkins .3—.5 inch long; capsules .2—.25 inch long, glabrous, subsessile or shortly stipitate.

Occurs along the main Himalayan range between 10,000 and 13,000 feet. Common on bare steep rocks or boulder-strewn ground above forest level, also frequent in forests of *Betula utilis* where it sometimes forms gregarious patches. The creeping stems often become half buried in the ground and root freely. Flowers: June-July. Fruit: October-November.

Var. microphylla, Anders. This has been collected by Duthie in the Palang Gadh, Byans in East Almora, vide his sheet no. 5969 in Herb., Dehra Dun. This variety has leaves up to 3 inch long only and the young shoots and midrib beneath are hairy. •

2. POPULUS, Linn. (*The Poplars.*)

Trees. Leaves alternate, 3—5-nerved at the base. Flowers dioecious. Disk cup-shaped, membranous or fleshy, often oblique, entire toothed or lobed. Stamens 4-many; filaments free. Ovary surrounded at the base or up to three-quarters of its length by the disk; stigmas 2—4; ovules many. Capsules 2—4-valved, valves spreading.

Populus ciliata, Wall. Vern. *Syān*, NG.—A large deciduous tree up to 10 feet girth and 140 feet high. Bark dark grey or brown with light grey or silvery patches, rough with deep longitudinal fissures 1-2 inches apart. Blaze .75 inch, rather fibrous, white. Leaves 3—7 by 2.5—5 inches, broadly ovate, acuminate, crenate-serrulate, teeth minutely ciliate, base usually cordate and 3—5-nerved, pale and often minutely pubescent beneath. Petiole 2—5 inches long. Catkins solitary, appearing before the new leaves in the axils of leaf-scars. Male flowers in compact catkins 3-4 inches long; bracts fringed with long hairs; disk obliquely cup-shaped, crenulate. Stamens many. Female flowers; disk embracing half the ovary, margin undulate. Fruiting catkins 6—12 inches long; capsules .3-.4 inch long, broadly ovoid; pedicels .1—4 inch long. Seeds enveloped in long silky hairs.

Occurs throughout the hills between 6,000 and 10,000 feet, but possibly not indigenous in the central and outer ranges. Fairly common on the inner ranges, usually bordering streams and occasionally forming small gregarious patches on the banks of the larger watercourses. The bark of young stems is quite smooth. The buds are sticky. Flowers: March-April. Fruit: June.

LXXXVIII.—LILIACEÆ.

Herbs, rarely shrubs or small trees; roots fibrous or rootstock creeping or a bulb or corm. Leaves various, sometimes minute and their functions performed by cladodes. Flowers usually bisexual. Perianth herbaceous or petaloid, usually 6-merous in 2 series, imbricate rarely valvate in bud. Stamens 6, rarely 3 or fewer, hypogynous or adnate to the perianth; filaments free or connate. Ovary 3-celled; ovules 2 or more; style usually long and simple, or styles 3. Fruit a 3-rarely 1-celled capsule or berry. Seeds 1 or more.

Stems leafy	...	...	...	1. <i>Smilax</i> .
Leaves replaced by needle-like cladodes	...	...	...	2. <i>Asparagus</i> .

1. SMILAX, *Linn.*

Climbing, rarely erect shrubs. Leaves alternate, rarely opposite; petiole usually with 2 cirrhi at the top of the sheath. Flowers small, dicecious, umbellate. Perianth of 6 usually incurved or recurved segments. Male flowers; stamens 6 or more, at the base of the perianth, free; anther-cells sometimes separated by the forking of the filament. Pistillode none. Female flowers; staminodes 3 or 6, filiform. Ovary 3-celled; ovules 1-2 in each cell; style short or none; stigmas 3. Fruit a globose 1—4-seeded berry.

I.—Stems erect, unarmed.

1. Deciduous. Leaves broadly ovate or suborbicular not papillose beneath. Flowers brownish ... 1. *vaginata*.
2. Evergreen. Leaves ovate or lanceolate, densely papillose beneath. Flowers green ... 2. *erecta*.

II.—Stems climbing by means of tendrils.

- A. Leaves usually armed as well as the stems. Umbels sessile forming a subracemose inflorescence ... 3. *aspera*.
- B. Leaves never armed. Umbels pedunculate.
 1. Stems unarmed. Flowers brownish. Umbels solitary.
 - (a) Deciduous. Sheath extending much more than half way down the petiole ... 4. *elegans*.
 - (b) Evergreen. Sheath not extending more than half way down the petiole ... 5. *parvifolia*.
 2. Stems armed. Flowers greenish (not seen in *S. macrophylla*).
 - (a) Sheath distinctly auricled.
 - (i) Umbels 1—8 ... 6. *Roxburghiana*.
 - (ii) Umbels 7—21 ... 7. *prolifera*.

(b) Sheath not auricled.

(i) Umbels usually 1 rarely 2. Pedicels .2—·5
inch long in flower. Staminodes 3 in
female flowers 8. *indica*.

(ii) Umbels usually 2-3. Pedicels .15—·25
inch long in flower. Staminodes 6 in
female flowers 9. *macrophylla*.

1. *Smilax vaginata*, Decsne.—An erect deciduous shrub usually 1—3 feet high rarely up to 6 feet with unarmed stems up to .25 inch diameter. Bark smooth, often dark purplish. Twigs terete. Leaves 1.5—3 by 1-2.5 inches, broadly ovate or suborbicular, obtuse or acute, entire, thin, not papillose beneath, base rounded or subcordate and strongly 3-nerved with 1-2 additional weaker pairs. Petiole .3—·8 inch long, sheathed half way up or less, without tendrils. Flowers .2 inch diameter, pinkish or purplish-brown, in axillary solitary pedunculate umbels. Umbels 3—7-flowered in the male, 1—3—usually 1-flowered in the female. Peduncles .3—·6 inch long, very slender. Pedicels .1—·3 inch long, filiform. Bracteoles 0. Staminodes 6 in the female flowers. Berry .3-4 inch diameter, globose, black with a glaucous bloom containing 1—4 smooth, shining, brown seeds.

Occurs throughout the hills between 7,500 and 10,500 feet. Fairly common in dense shady forest, more especially of *karshu*, spruce and silver fir where it often forms gregarious patches of undergrowth. The young leaves are often characteristically blotched or edged with pinkish. Flowers: April—June. Fruit: October.

2. *Smilax erecta*, Osmaston.—An evergreen shrub with slender erect unarmed stems 1-2 feet high and up to .2 inch diameter. Bark smooth, greenish. Twigs slender, terete. Leaves 1.5—3 by .75—1.75 inches, ovate or lanceolate, acute or acuminate, entire, subcoriaceous, densely papillose beneath, base rounded and 5—7-nerved. Petiole .25—·75 inch long, sheathed half way up or more, often bearing two simple unbranched tendrils usually .1—·3 inch long at the top of the sheath. Flowers .2 inch diameter, green, in axillary solitary peduncled umbels. Umbels 1—5-flowered in the male, 1-2-flowered in the female. Peduncle .2—·6 inch long in the male, up to 1 inch in the female, very slender. Pedicels .2—·6 inch long, filiform. Bracteoles minute. Berry .25—·3 inch diameter, globose or ovoid, black with a glaucous bloom containing a single seed.

Occurs on the main Himalayan range in North Garhwal between 7,000 and 8,500 feet. It is more or less gregarious, sometimes forming dense patches of undergrowth in shady forest of cypress or *banj*. It has been collected in the Kulgari Gadh of the Nawal reserve and near Kanol in the Nandagiri Valley (vide my specimens nos. 926 and 1076 in Herb., Dehra Dun) in both of which localities it is fairly common. Flowers: May-June.

3. *Smilax aspera*, Linn.—An evergreen climber usually 5—10 feet high, but attaining 30 feet with armed stems up to .4 inch diameter.

Bark green. Twigs striated. Prickles curved, up to .2 inch long. Leaves variable in size, usually 3—6 by 1.5—4.5 inches, deltoid-ovate or lanceolate, acute or acuminate, entire, subcoriaceous, dark glossy green on both surfaces, midrib beneath and leaf margin often prickly, base rounded truncate or cordate and 5—9-nerved. Petiole .5—1 inch long, prickly or not, narrowly margined for one-quarter to one-third its length, the sheath ending in two simple tendrils up to 2.5 inches long. Flowers .2-.3 inch diameter, white, sweet-scented, arranged umbellately on the tumid nodes of axillary and terminal rachises. Rachis of male inflorescence up to 8 inches long, of female up to 3 inches long. Bracteoles minute. Pedicels .2—4 inch long. Sepals and petals .15—.2 inch long in the male, shorter in the female flowers. Staminodes 6 in female flowers. Berry .25—.3 inch diameter, globose, pink, red or black when ripe containing 1—3 seeds surrounded by juicy pulp.

Occurs throughout the hills between 3,000 and 7,000 feet. Very common, often associated with *banj*, also in scrub forests. Flowers: September—November. Fruit: May, June.

4. *Smilax elegans*, Wall. Syn. *S. menispermoidea*, A. DC.—A deciduous climber with slender wiry unarmed stems 5—10 feet high and up to .25 inch diameter. Bark green or blackish towards the base, smooth. Twigs terete. Leaves 2—4 by 1.5—3 inches, broadly ovate, acute, entire, base 5-nerved sometimes with a weak additional pair below, rounded truncate or cordate. Petiole .4—1.5 inches long, sheathed to within about .1 inch of the top, bearing two simple unbranched tendrils up to 3 inches long at the top of the sheath. Axillary branches with an oblong-ovate cuspidate basal scale .3—.7 inch long, sheathing the base of the branch. Flowers .2 inch diameter, purplish-brown, in axillary, solitary, pedunculate pendent umbels. Umbels 4—11-flowered in the female, 5—15 in the male. Peduncle 1—1.5 inches long. Pedicels .4—.6 inch long, slender, pink. Bracteoles small. Berry .3-.4 inch diameter, subglobose, black with a glaucous bloom, containing 1—4 pale brown seeds.

Occurs along the main Himalayan range between 9,000 and 11,000 feet. Fairly common, usually in open forests of *karshu*. Flowers May-June. Fruit: October-November.

5. *Smilax parvifolia*, Wall. Vern. *Kukardāra*, Gen. (This name is also applied to other species of *Smilax* without discrimination).—An evergreen climber with slender wiry unarmed stems up to 10 feet high and .35 inch diameter. Bark smooth, greenish. Twigs not striate. Leaves variable in size and shape, 2—5 by .5—4.5 inches, the smaller usually ovate-lanceolate with rounded base, the larger broadly

ovate with deeply cordate base, acute or acuminate, entire, subcoriaceous, not papillose beneath, base 5—7-nerved. Petiole .2—·75 inch long, sheathed half way up or less, bearing two simple unbranched tendrils usually .5—1 inch long at the top of the sheath. Flowers .2 inch diameter, pale pinkish-brown, in axillary solitary pedunculate umbels. Umbels 2—5-flowered in the female, 4—23-flowered in the male. Peduncle .4—·7 inch long, slender. Pedicels .1—·4 inch long, filiform. Bracteoles minute. Staminodes 1—3 in female flowers. Berry .2—·3 inch diameter, globose, black with a glaucous bloom, containing 1-2 (usually 1) smooth white globose seeds surrounded by juicy purple pulp.

Occurs throughout the hills between 3,000 and 8,000 feet. Common in open *banj* forests. When the plant is young and before the stems have found a support they are erect. Flowers : April—June. Fruit : October.

6. *Smilax Roxburghiana*, Wall.—An evergreen climber 10—25 feet high with stems up to .75 inch diameter. Bark smooth, yellowish-green. Branches terete, armed with scattered recurved prickles up to .2 inch long. Young shoots with a glaucous bloom. Leaves rather variable in size, usually 5—10 by 2.5—7 inches, elliptic or ovate, acute or acuminate, entire, coriaceous, dark glossy green above, paler and slightly glaucous beneath, base rounded or obtuse and 5-nerved, the inner lateral pair usually united with the midrib for a short distance above the base. Petiole .5—2 inches long, with a broad 2-auricled sheath running one-third to two-thirds the way up and often bearing two large simple tendrils. Auricles .2—1 inch broad, their rounded bases often overlapping on the other side of the branch, the upper end terminating in two acute lobes. Flowers pale yellowish-green, faintly scented, in dense axillary umbels about 1 inch across, 10—25-flowered in the female, up to 50-flowered in the male. Buds .15—·2 inch long. Umbels solitary or 2-3 on a common peduncle. Pedicels .2—·35 inch long, lengthening in fruit. Sepals and petals recurved. Staminodes 3 in female flowers. Berry .3—·4 inch diameter, globose. Seeds 2.

Occurs throughout the hills between 3,000 and 6,000 feet. Scarce. Usually found in moist ravines. Flowers : April—June. Fruit : April-May.

7. *Smilax prolifera*, Roxb.—An evergreen climber 10—30 feet high with stems up to 1.25 inches diameter. Bark smooth, green. Stems armed with straight prickles up to .25 inch long. Leaves rather variable in size 4—10 by 2—7 inches, elliptic-oblong or ovate, apex usually rounded and cuspidate, entire, coriaceous, dark glossy green above, base rounded and 5-or rarely 7-nerved, the inner lateral pair united with the midrib for a short distance above the base. Petiole

·75—3 inches long, with a two-auricled amplexicaul sheath running one-quarter to one-half the way up and ending in two simple tendrils up to 12 inches long. Auricles usually ·2—·4 inch broad, their bases not overlapping. Flowers green, sweet-scented, in dense many-flowered umbels. Umbels 7—21, 3-nate or rarely solitary, arranged on an axillary rachis 2—4 inches long. Peduncles ·5—1 inch long. Pedicels ·2—·4 inch long in flower. Petals and sepals ·15—·2 inch long, recurved. Berries ·2—·4 inch long, ovoid, pink or red.

Occurs throughout the subhimalayan tract and outer hill ranges up to 2,500 feet. Common in shady ravines and often abundant in swampy places. Flowers: February—April. Fruit: December—February.

8. *Smilax indica*, Vitm. Syn. *S. villandia*, Wall.—A deciduous climber up to 25 feet high with stems up to 1 inch diameter. Bark quite smooth, greenish when young pinkish-brown when old, but always densely freckled or mottled with a paler shade. Stems more or less armed with recurved prickles up to ·2 inch long. Leaves variable in size, 3·5—10 by 1·5—8 inches, elliptic or elliptic-ovate, acute or sub-cuspidate, entire, glossy on both surfaces, base rounded or obtuse and 5-nerved, the inner lateral pair usually united with the midrib for a short distance above the base. Petiole ·3—1 inch long, narrowly winged for one-quarter to half its length, the sheath not auricular and ending in two simple tendrils up to 4 inches long. Flowers yellowish-green, scented, in dense axillary umbels about 1·5 inches across, 20—45-flowered. Buds ·3—·35 inch long. Umbels usually solitary, rarely 2 on a common peduncle. Sepals and petals recurved. Bracteoles small, numerous. Pedicels ·2—·5 inch long, lengthening in fruit. Staminodes 3 in female flowers. Berry ·4·5 inch diameter, globose, red when ripe.

Occurs throughout the subhimalayan tract between 1,500 and 3,500 feet. Common in sal forest, especially in ravines, also in dry miscellaneous forest. Flowers: July-August.

9. *Smilax macrophylla*, Roxb.—A large climber, the branches and stems usually prickly. Branches striate. Leaves variable, usually 4—8 by 2·5—8 inches, but sometimes very much larger, elliptic ovate or orbicular, cuspidate, thinly coriaceous, shining above, base rounded and more or less abruptly and shortly cuneate on the petiole, 5—7-nerved. Petiole ·5—1·5 inches long, with a narrow amplexicaul sheath extending from one-quarter to one-half the way up the petiole and usually ending in two simple tendrils up to 12 inches long. Flowers in many-flowered umbels. Umbels usually 2-3, sometimes 1 or 4 on a common axillary peduncle. Bracteoles small, numerous. Peduncles ·5—·75 inch long. Pedicels ·15—·25 inch long. Petals and sepals ·2·3 inch long,

ultimately reflexed. Stamminodes 6 in female flowers. Berry .3 inch diameter, globose, orange or red when ripe.

Probably occurs along the whole subhimalayan tract up to about 2,000 feet, but there is only one specimen of this plant at Dehra Dun collected in the Sarda range, Haldwani Division by Sirtaj Bahadur. Flowers: July-August.

2. ASPARAGUS, *Linn.*

Herbs or undershrubs often climbing, stem dying to the ground periodically, root-stock various. Leaves reduced to minute scales, often spinescent, bearing in their axils tufts of needle-like or flattened branchlets (cladodes). Flowers small, 1-or 2-sexual, axillary, solitary, fascicled or racemed; pedicels jointed. Perianth petaloid, 6-partite, campanulate or spreading. Stamens 6, inserted at the base of the perianth-segments. Ovary 3-celled; ovules 2 or more in each cell; style short; stigmas 3. Fruit a globose usually 1-seeded berry.

I.—Flowers solitary or in small clusters. Cladodes in
tufts of 2—8, straight ... 1. *gracilis*.

II.—Flowers in racemes.

1. Cladodes .4 inch long or more.

(a) Cladodes in tufts of 2—6. Spines often
recurved ... 2. *racemosus*.

(b) Cladodes in tufts of 6—20. Spines straight ... 3. *ascandens*.

2. Cladodes .1—.25 inch long ... 4. *Curillus*.

I have not included *A. filicinus*, Buch.-Ham, as this plant has herbaceous, not woody stems. They are 2—4 feet high and unarmed. Cladodes .2—.4 inch long in tufts of 2—5. Flowers solitary or paired on long filiform pedicels. This is the only other species of *Asparagus* occurring in our area. It is fairly common in forests between 7,000 and 10,000 feet.

1. *Asparagus gracilis*, Royle.—A slender suberect undershrub. Stems terete, smooth. Lower leaves subtending the larger branches often transformed into broad downwardly-directed spines up to .1 inch long. Cladodes .1—.6 inch long, in tufts of 2—8, needle-like or setaceous. Flowers solitary or in clusters of 2—8, often terminating short branchlets. Pedicels .1—.2 inch long, jointed at or below the middle. Perianth usually .12 inch long. Stamens half as long as the perianth. Berry .15—.2 inch diameter, red.

Probably occurs throughout the central and outer hill ranges between 1,500 and 4,000 feet. Scarce, and I have only seen specimens from Ramnagar and from Kanari Cheena in the Almora district, though reported to occur in other localities. Flowers: June—August.

2. *Asparagus racemosus*, Willd. Vern. *Jhirna*, G. *Kairua*, A. (These names are used indiscriminately for any species of *Asparagus*).—A tall climbing undershrub with annual woody terete stems. Branchlets triquetrous. Spines .2—.5 inch long, recurved or rarely straight. Cladodes .5—.1 inch long, in tufts of 2—6, curved. Flowers white

fragrant, in solitary or fascicled, simple or branched racemes 1-2 inches long. Pedicels .2 inch long, jointed in the middle. Perianth about .12 inch long. Stamens as long as the perianth. Berry .2—.25 inch diameter, red.

Occurs along the subhimalayan tract and outer hill ranges up to 4,000 feet. Probably not very common. Flowers: October-November.

3. *Asparagus adscandens*, Roxb.—An undershrub with annual erect or scrambling stems up to 10 feet high and .75 inch diameter. Bark smooth, pale brown. Branchlets subtended by a stout sharp spine up to .75 inch long, straight, either ascending or reflexed. Twigs striate and scabrid on the ridges. Cladodes .4—.9 inch long, in tufts of 5—25, straight, acicular. Flowers white, in numerous racemes 1—4 inches long; racemes simple or branched, often bearing cladodes towards the top. Pedicels .1-.2 inch long, filiform, jointed above or below the middle. Perianth scarcely .1 inch long. Stamens shorter than the perianth. Berry .3-.4 inch diameter, subglobose, more or less 3-lobed, red when ripe, containing 1—3 shining black spherical seeds .2 inch diameter.

Occurs throughout the subhimalayan tract and the central and outer hill ranges up to 5,000 feet. Fairly common. Flowers: October-November. Fruit: April.

4. *Asparagus Curillus*, Buch.-Ham.—An undershrub with erect or subscandent stems 2—6 feet high and up to .35 inch diameter. Bark pale or straw-coloured. Branchlets subtended by a slender sharp spine up to .75 inch long, nearly straight. Twigs striate and scarbid on the ridges. Cladodes .1—.25 inch long, in tufts of 3—10, nearly straight, flattened, linear-oblongate, acute. Flowers .25 inch diameter white, in few-flowered racemes; racemes .5—2 inches long, solitary or 2-3 together, simple or branched, naked or bearing cladodes. Pedicels .1-.2 inch long, jointed at or below the middle. Perianth .15 inch long. Stamens shorter than the perianth. Berry .2—.4 inch diameter, subglobose, red. Seeds 1-2, shining, black.

Occurs throughout the hills between 3,000 and 8,000 feet. Common in open *banj* forest and in secondary scrub. Flowers: May—July. Fruit: October-November.

LXXXIX.—PALMACEÆ.

Shrubs or trees, usually with a terminal unbranched crown of large leaves, sometimes scandent. Leaves alternate, plaited, palmate or pinnately divided, rarely simple; petiole sheathing. Flowers mostly small in simple or branched inflorescences (spadices) sheathed at the base and often at the base of the branches, dioecious, the males and females nearly always differing in form. Perianth usually dry and coriaceous, in 2-3-merous whorls, usually free, imbricate or valvate. Stamens 3 or 6, rarely more. Ovary superior, apocarpous, of three 1-celled carpels, or syncarpous and 1—3-celled; stigmas usually sessile; ovules 1-2 in each carpel. Fruit various, apocarpic or syncarpic, indehiscent.

I.—Stemless or with erect stems.

1. Leaves pinnate.

(a) Leaflets more than 1 inch broad, lower not
spinescent ... 1. *Wallichia*.

(b) Leaflets 1 inch broad or less, lower spinescent 2. *Phoenix*.

2. Leaves fan-shaped ... 3. *Trachycarpus*.

II.—Stems scandent ... 4. *Calamus*.

1. WALLICHIA, *Roxb.*

Stemless or rarely simple-stemmed palms. Leaves pinnatisect; leaflets linear or oblong, irregularly toothed, base cuneate. Spathes many, tubular, clothing the peduncle of the spadix, upper ones large. Spadices interfoliar, monœcious or polygamous; males ovoid, excessively branched and dense-flowered; females looser-flowered. Male flowers symmetric; calyx cylindric or cupular, membranous, truncate; corolla cylindric, deeply 3-lobed, lobes oblong valvate; stamens 6 on the corollatube, filaments short; pistillode 0. Female flowers much smaller, subglobose; sepals orbicular, coriaceous, imbricate; petals triangular, valvate; ovary 2-3-celled, stipitate. Fruit ovoid-oblong, 1—3-celled and-seeded.

Wallichia densiflora, *Mart.*—An elegant palm with little or no stem. Trunk sheathed. Sheaths villous, resolving into strong fibres. Leaves 5—10 feet long. Rachis of young leaves clothed with rusty-brown scurf disappearing from the upper portions as the leaves mature, the lower half of the rachis often without leaflets. Leaflets many,

alternate or subopposite, or the lower 2—4-nate, 9—18 inches long, oblong or linear-oblong, sinuate, acutely and finely serrulate with prominent midrib and many parallel nerves, dark glossy green above, silvery white beneath; terminal leaflet triangular, more or less 3-lobed with 3-4 strong nerves. Male flowers numerous, yellow, solitary or the lower in pairs with a rudimentary female between, in numerous slender spikes forming an axillary curved often pendulous spadix about 1·5 feet long. Spathes imbricated, equalling the flower-bearing part of the spadix. Female flowers purplish, crowded, arranged on the stout ascending green branches of the spadix. Calyx very short, divided to the middle into 3 rounded teeth. Corolla trifid. Spathes brown, conduplicate, the outer one sometimes very long and acuminate. Fruit about ½ inch long, oblong, dull purple surrounded at the base by the perianth.

Occurs in the central and outer hills between 1,000 and 3,000 feet. Fairly common in the outer hills, usually in deep shady ravines. Flowers: May—July according to Blatter, but I think this requires confirmation for our area.

2. PHŒNIX, *Linn.*

Tall or short palms; stems clothed for a considerable time with the bases of the fallen leaves. Leaves pinnate with linear, lanceolate or ensiform leaflets which are frequently fascicled and often spinescent. Flowers coriaceous, in branched erect or ultimately drooping interfoliar spadices. Calyx cupular, 3-toothed. Male petals 3, obliquely ovate; stamens usually 6; pistillode minute or none. Female flowers globose; calyx accrescent; petals rounded, imbricate; staminodes 6 or a 6-toothed cup; carpels 3, free; stigmas sessile. Fruit an oblong drupe with a fleshy pericarp.

- | | | | | |
|--|-----|-----|-----|------------------------|
| Stem 30—50 feet high. Fruit 1—1·2 inches long, orange-yellow when ripe | ... | ... | ... | 1. <i>sylvestris</i> . |
| Stems 5—20 feet high. Fruit ½—7 inch long, black when ripe | ... | ... | ... | 2. <i>humilis</i> . |
| Stem 0—6 inches high, globose, bulb-like. Fruit ½—7 inch long, black when ripe | ... | ... | ... | 3. <i>acaulis</i> . |

1. *Phoenix sylvestris*, *Roxb.*—A tall graceful palm 30—50 feet high. Stems rough from the persistent bases of the leaf-stalks. Leaves 10—15 feet long; rachis compressed only towards the apex. Leaflets 6—18 by 7—1 inch, glaucous, rigid, 2—4-farious, almost spinous-pointed. Male flowers white, scented; spadix 2-3 feet long, erect; peduncle much compressed. Spathes 12—16 inches long, scurfy, separating into 2 boat-shaped valves. Flowers 25—35 inch long, numerous. Female flowers distant; calyx cup-shaped, obsoletely 3-toothed; petals very broad, convolutedly imbricate; spadix and spathe as

in the male. Fruiting spadix 3 feet long, nodding; the peduncle 1—1·5 inches broad, much compressed, golden-orange coloured. Fruit 1—1·2 inches long, oblong-ellipsoid, orange-yellow.

This palm is found wild in adjoining plains districts and is said to form extensive forests along the Ramganga river in Rohilkhand, but I am doubtful whether it actually occurs wild within our area. There are I believe some palms of this species planted at Bageshar in the Almora district. The base of the stem is surrounded by a mass of small roots. Flowers: April-May. Fruit: September-October.

2. *Phoenix humilis*, Royle. Vern. *Khajūr*, Gen. *Thākal*, EA and H.—A medium-sized palm with stems 5—20 feet high and up to 12 inches diameter. Stems densely covered with the stumps of the leaf-stalks. Leaves 4—8 feet long, pinnate. Leaflets 10—20 by 4·5 inch, pliable, fascicled, more or less quadrifarious, bases thickened but not decurrent on the common petiole, degenerating into spines towards the base. Male flowers 1·5—2 inch long, creamy white, scented; spadix about 12 inches long, rather longer than the spathe; spathe about 2·5 inches broad and 5 inch thick, splitting to allow the inflorescence to pass through. Female flowers yellowish-green, globose; spathe as in the male. Fruiting spadix 1·4 feet long, bright orange-yellow; the peduncle compressed, up to 3 feet long, and 75 inch diameter; spikes 5—10 inches long. Fruit 5—7 inch long, oblong, dull red at first, black with a glaucous bloom when fully ripe.

Occurs throughout the hills between 1,000 and 6,500 feet. Common in dry miscellaneous *sal* and *chir* forests, especially in shady ravines. In some places it is becoming exterminated owing to the practice of removing the edible growing point of the stem. Flowers: October-November. Fruit: June-July. The species here described is *var. typica*, Becc. For some years the growth is very slow and the stem being scarcely raised above the ground level it much resembles *P. acaulis*. In *sal* forest the stem seldom exceeds 5 feet high.

3. *Phoenix acaulis*, Buch.—Ham. Vern. *Khajūr*, Gen. *Thākal*, EA.—A dwarf palm; the globose bulb-like stem 6—9 inches diameter and densely covered with the stumps of the leaf-stalks. Leaves 3—5 feet long, pinnate. Leaflets 10—20 by 4—8 inch, rather stiff, arranged irregularly along the rachis or subopposite, the bases thickened and slightly decurrent forming a raised ridge along the common rachis up to 5 inch long, degenerating into spines towards the base. Male flowers 25—35 inch long, pale yellow; spadix about 6 inches long and 1—1·25 inches broad. Fruiting spadix 6—9 inches long, pale yellow; the peduncle compressed, up to 4 inches long and 75 inch diameter; spikes 4—6 inches long. Fruit 5—7 inch long, oblong, blueblack when ripe.

Occurs throughout the subhimalayan tract in open grassy areas up to 1,500 feet. Abundant in many grasslands which are annually burnt such as the Patli Dun. The stem is usually more or less completely buried beneath the ground. The whole fruiting peduncle, and usually part of the fruiting spikes as well, is hidden between the leaf-bases. Flowers: November-January. Fruit: April-May.

3. TRACHYCARPUS, *Wendl.*

Tall unarmed palms. Leaves suborbicular or reniform, plicately multifid; segments narrow, rachis 0. Spadices many, interfoliar, stout, branched; spathes many, sheathing, coriaceous, compressed, tomentose; bracts and bracteoles minute. Flowers small, polygamo-monoëcious. Sepals 3, ovate. Petals 3, broadly ovate, valvate. Stamens 6, filaments free. Carpels 3; stigmas 3, recurved. Drupes 1—3, globose or oblong.

Trachycarpus Takil, *Becc.* Vern. *Tākal* or *Jhagerau*, G.—A medium-sized palm with erect stem up to 30 feet high and 12 inches diameter covered with a fibrous network, the upper portion more or less hidden by the persistent dead leaves which hang down. Leaves 3—6 feet long, fan-shaped, suborbicular, plicate, margin segmented; the segments shortly bifid or bidentate at the tip, glaucous beneath. Petiole 1—4 feet long, subtrigonous, the margins armed with minute irregular subspinescent teeth. Flowers greenish-yellow, clustered on the branches of a paniculate spadix 12—24 inches long; peduncle compressed, 1—1.5 inches broad, reflexed in fruit. Male flowers: sepals suborbicular; petals twice as long as the calyx. Spathes 2-3, 8—10 inches long, reddish-brown, densely clothed with deciduous scurfy tomentum. Drupe reniform.

Occurs throughout the central and inner ranges between 6,000 and 8,000 feet, but its occurrence is somewhat local, and I only know of three localities where it grows in Garhwal. It is usually found in shady forests of *Quercus incana* on north aspects, but is sometimes associated with *Quercus dilatata*. Flowers: April-May.

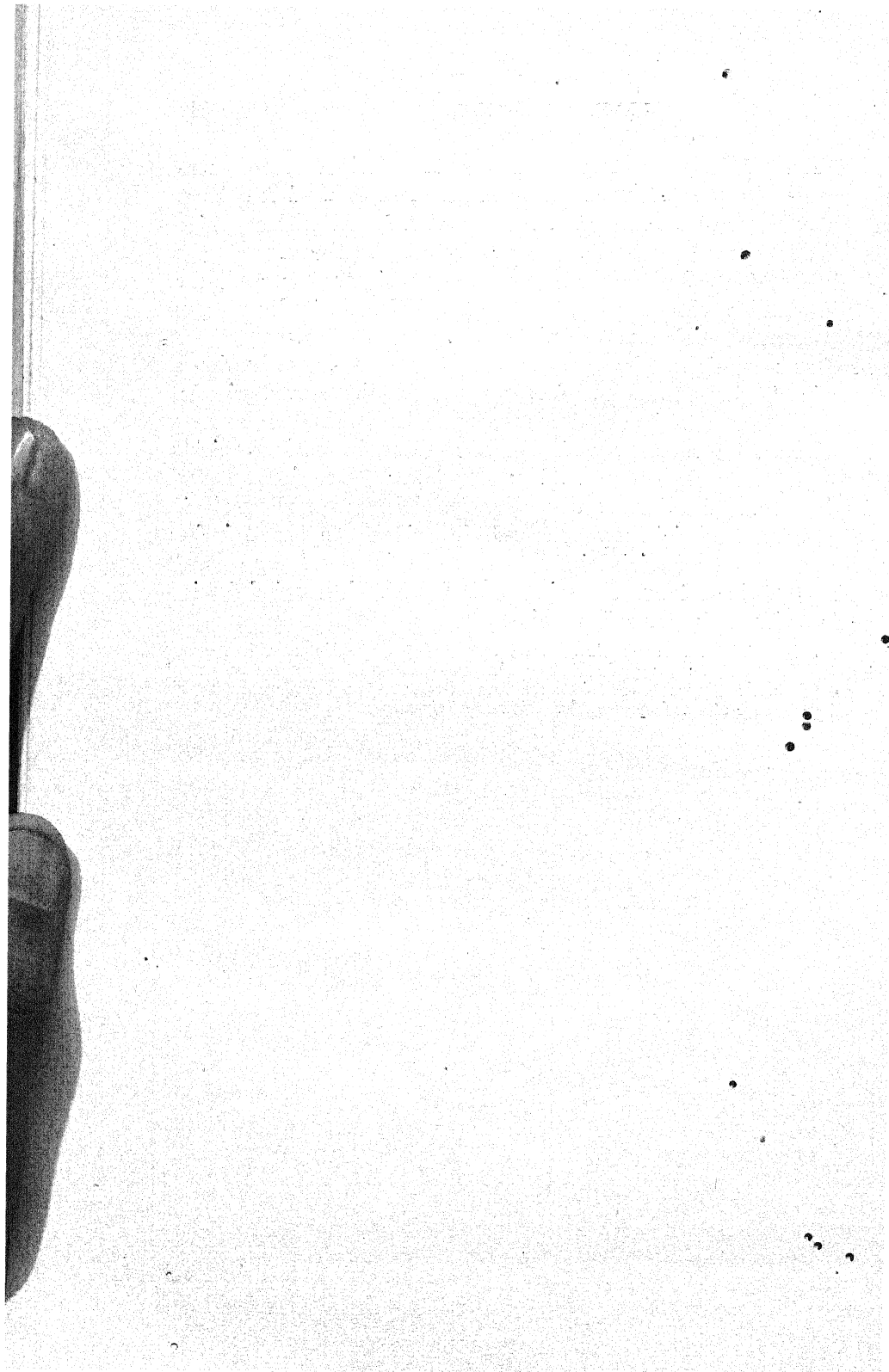
4. CALAMUS, *Linn.*

Usually scandent palms armed with long spines or recurved prickles, frequently climbing by the aid of long prickly flagella which may be a continuation of the leaf-rachis or an appendage to the leaf-sheath or a continuation of the spadix or its spathes. Leaves not confined to a terminal crown, pinnate or pinnatisect, midrib often armed. Spadices interfoliar, compound, with tubular or open persistent spathes. Flowers small, polygamo-diœcious, in solitary or binate spikelets. Male calyx cupular, 3-toothed; petals 3, acute, coriaceous; stamens 6. Female calyx as in the male; corolla tubular below, 3-fid; staminodes forming a cup. Ovary incompletely 3-celled, clothed with retrorse scales; stigmas 3. Fruit with thin pericarp clothed with polished retrorse scales.

Calamus tenuis, *Roxb.* Vern. *Bêt*, Gen.—A climbing palm, the stems scrambling by means of prickles on the leaves and attaining 30

feet high and .75 inch diameter. Stems smooth, bright green, more or less covered by the persistent leaf-sheaths. Leaves 2—4 feet long, pinnate; rachis armed beneath with one row of recurved prickles which become smaller towards the tip. Leaflets many, smaller towards the top, 6—12 by .4—7 inch, linear-lanceolate, acuminate, 3-nerved, the nerves and margins with scattered bristles or prickles, dark glossy green on both surfaces. Petiole stout. Petiole and leaf-sheath sparingly armed with needle-like straight spines up to 1 inch long, the sheath bearing a slender whip-like flagellum up to 8 feet long armed with recurved prickles. Spadices branched, 4—7 inches long, arranged along a common axillary rachis which attains several feet in length and terminates in a prickly flagellum. Spathes elongate, tubular; the lower 6—10 inches long, armed with recurved prickles; upper scurfy. Flowers small, male in 3-4 series, female distichously arranged, in spikelets up to 4 inches long, the lower often paniced in the male. Fruit resembling a small cone, about .4 inch long, ellipsoid, clothed with closely imbricating pale scales with dark-coloured margins.

Occurs throughout the subhimalayan tract up to 2,000 feet. Abundant in swampy localities. The aerial stems are produced from rhizomes which run along the surface of the ground and under favourable conditions the dense masses of hanging stems with their prickly foliage become almost impenetrable. Flowers: July-August.



XC.—ARACEÆ.

Herbs, rarely shrubby and then usually scandent; stem often a tuber or rhizome bearing annual shoots. Leaves usually more or less fleshy, simple, lobed or palmately or pedately divided, membranous sheaths usually present at the base of the petiole or peduncle. Flowers small or minute, crowded on a simple fleshy spadix with green or coloured spathe, rarely few, bisexual or usually monœcious with the male and female inflorescences on different parts of the same spadix, very rarely diœcious. Spadix often produced beyond the flowers into an "appendix". Perianth 0 or inferior, cupular or of 4—8 segments. Anthers in hermaphrodite flowers 4—8, in monoœcious flowers 1-many, often united into "synandria." Ovary entire, very rarely lobed, 1-many-celled. Style 0 or various. Ovules 1-several in each cell. Fruits mostly baccate, distinct or confluent.

- A. Perianth present. Ovary 3-celled, cells 1-ovuled.
 Spadix stipitate or sessile 1. *Pothos*.
- B. Perianth 0. Spadix sessile.
 - 1. Ovary 2-celled, cells many-ovuled 2. *Raphidophora*.
 - 2. Ovary 1-celled with 1 basal ovule 3. *Scindapsus*.

1. POTHOS, Linn.

Herbs or shrubs scandent by means of the adventitious roots. Leaves distichous, articulate to the usually winged petiole, simple. Spathe small, reflexed, persistent. Spadix sessile or stipitate, peduncled below the spathe. Flowers bisexual; sepals 6 with incurved tips; stamens 6, filaments flat. Ovary 3-celled, stigma small, ovules 1 in each cell. Berries 1—3-seeded.

Pothos Cathcartii, Schott.—An evergreen climber with dark green, smooth, terete, woody stems which attain 60 feet high and .6 inch diameter. Internodes .5—1.5 inches long. Leaves alternate, 3.5—7 by 1.25—2 inches, oblong or ovate-oblong, acuminate, base rounded, dark glossy green above, pale and glossy beneath, thick, nerves indistinct. Petiole .75—4 inches long, winged on either side to form a leaf-like expansion .3—1 inch broad at the broadest part, slightly widening upwards and rounded at the top. Peduncle solitary, axillary, .5—7 inch long below the spathe, partly hidden by 4 or 5 imbricating bracts. Spathe suborbicular, cordate, cuspidate, the edges incurved, .5-.6 inch across, green usually tinged with purple. Stipe .2-.3 inch long terminating in an ellipsoid, yellow, fleshy, many-flowered spadix .3—.5 inch long. Berries scarlet, .5—7 inch long.

Occurs throughout the outer hill ranges between 1,500 and 2,500 feet. Not very common and always in moist and shady ravines. It is mainly found climbing up the trunks of trees but also occasionally on banks or rocks. The climbing stems produce leaves which are more or less reduced, especially the blade. Certain branches near the ground grow downwards instead of upwards. These produce reduced leaves at first but subsequently remain leafless. They root freely at the nodes in contact with the ground. The normal climbing stems produce numerous drooping leafy branches 2-4 feet long which are flower-bearing. Flowers: March-April.

2. *RAPHIDOPHORA*, Schott.

Suffruticose climbers, clinging by their adventitious roots. Leaves distichous, entire or pinnatifid, usually large; petiole geniculate at the tip. Spathe coriaceous, ovate, acuminate, deciduous. Spadix sessile above the spathe, stout, elongate. Flowers crowded, bisexual; perianth 0; stamens 4-6 with very short flattened filaments. Ovary obconic, truncate, sub-2-celled; ovules many, parietal. Berries many-seeded and confluent.

***Raphidophora glauca*, Schott.**—An evergreen climber with somewhat woody stems up to 40 feet high and 1.25 inches diameter clinging close to its support by means of strong adventitious roots. Bark smooth, pale brown when old, bright green when young. Leaves 7-12 by 4-9 inches, obliquely ovate, base cordate on one or both sides, pinnatipartite with 1-2 deep cuts on either side of the midrib or less frequently quite entire, thick, glossy green; lateral nerves arcuate. Petiole 4-12 inches long, not winged but with a deep groove along the upper surface over which is stretched a deciduous thin membrane. Peduncle solitary, sub-terminal, rather slender, 2-4 inches long. Spathe 2.5-3.5 inches long, fleshy, ovate-oblong or lanceolate-oblong, cuspidate, salmon coloured inside. Spadix sessile, cylindric, pale yellowish, 2-3 inches long by about .5 inch diameter. Fruiting spadix erect.

Occurs throughout the outer hill ranges between 1,500 and 4,500 feet. Abundant in shady damp well-wooded ravines where it climbs up the stems of trees or over rocks and steep banks. Flowers: August-September.

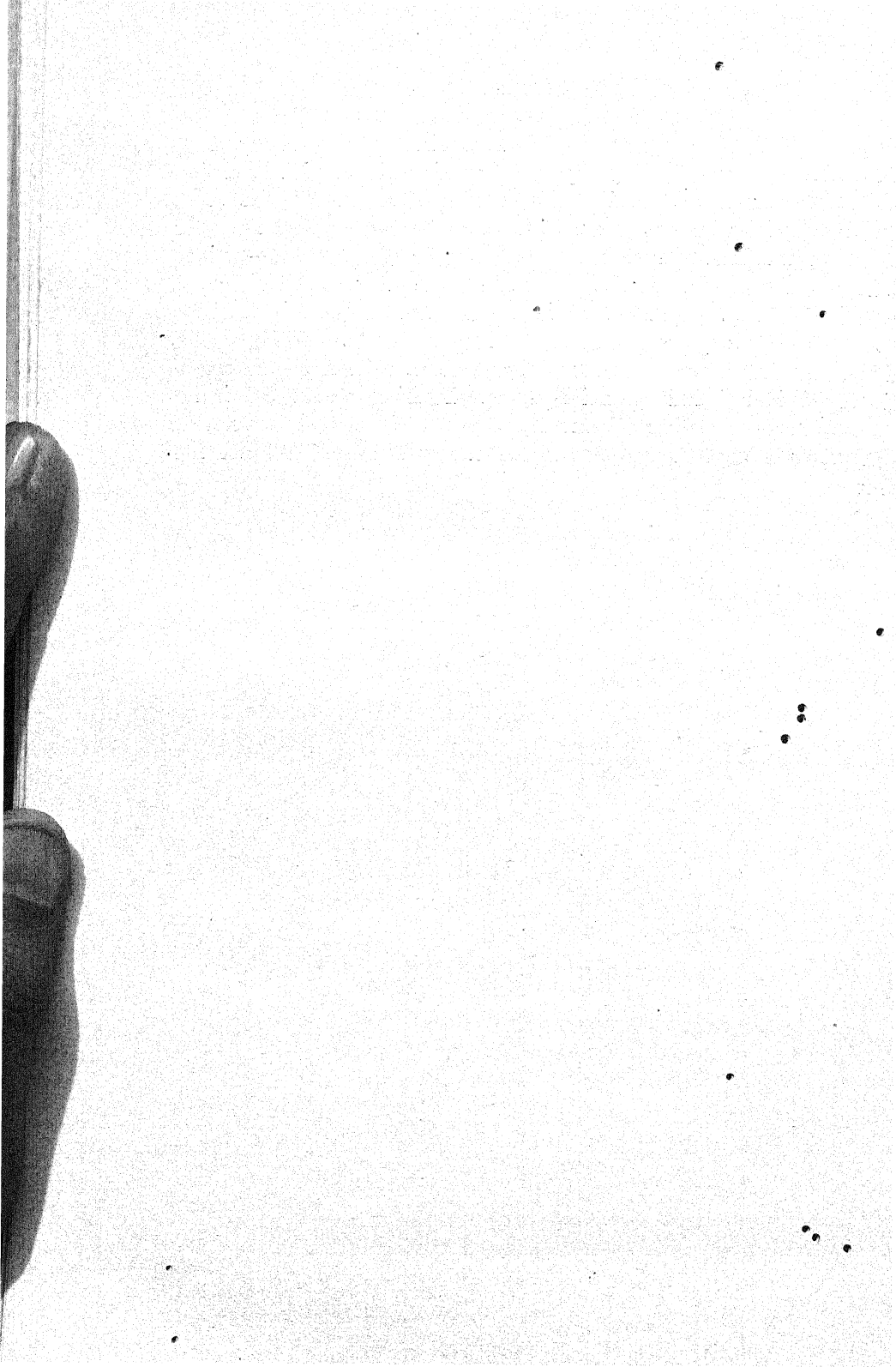
3. *SCINDAPSUS*, Schott.

Stout suffruticose climbers clinging by adventitious roots. Leaves usually large, distichous, entire or pinnatifid. Spathe coriaceous, acuminate, deciduous. Spadix sessile above the spathe, stout. Flowers crowded, bisexual; perianth 0; stamens 4-6 with short flattened filaments. Ovary obconic, truncate, 1-celled; ovule solitary. Berries 1-seeded, confluent or closely adpressed.

***Scindapsus officinalis*, Schott.**—A deciduous climber with rather soft and succulent stems up to 60 feet high and 2 inches diameter clinging close to the trunks of trees by means of adventitious roots. Bark on young stems smooth, pale brown or pale ashy, on old stems

very corky and deeply furrowed. Leaves alternate, 6—12 by 4—8 inches, obliquely ovate-oblong, apex rather abruptly cuspidate, entire, base rounded or slightly cordate, lateral nerves arcuate. Petiole 4—7 inches long, with a knee about .25 inch from the top, winged from the base up to the knee, the base amplexicaul; winged base .6—.8 inch broad gradually tapering upwards. Peduncle solitary, terminal, stout, 2—2.5 inches long. Spathe 4—6 inches long, oblong, terminated by a cusp .5—.7 inch long, green outside, dull yellow inside. Spadix sessile, cylindric, slightly narrowed at both ends, about as long as the spathe and .75—1 inch broad, greenish-yellow. Fruiting spadix 5-6 inches long and 1.25—1.75 inches diameter, pendent, with a scaly appearance formed by the exposed surfaces of the closely adpressed but not confluent berries.

Occurs throughout the subhimalayan tract and outer hill ranges between 1,000 and 3,000 feet. Very common in *sal* forest. Flowers: June probably.



XCI.—GRAMINEÆ.

Tribe Bambuseæ.

Perennial woody grasses, often gregarious. Rhizome stout, creeping, usually knotted and tufted, producing ascending stems (culms) at intervals. Culms cylindric, jointed, hollow between the joints, each joint (node) giving rise to a thin or coriaceous sheath (culm-sheath), which terminates in a more or less imperfect blade. Culm-sheaths alternate bearing buds in their axils. Leaves distichous, narrow, midrib prominent; petiole very short. Blade jointed to the amplexicaul split sheath, with an appendage (ligule) at the junction. Inflorescence usually a large compound panicle with spicate branches. Flowers in spikelets consisting of a number of bracts (glumes), the lower 1 or more empty, the upper also sometimes empty or bearing imperfect flowers. Flowering glumes 1-several in each spikelet, each with an axillary membranous bract (palea), enclosing a flower between each flowering glume and palea. Flowers usually of 2-3 small scales (lodicules) representing the perianth, besides the stamens or pistil or both. Stamens 3 or 6, rarely more or fewer; filaments capillary; anthers versatile. Ovary superior, 1-celled; ovule solitary; stigmas 2-3. Fruit a caryopsis, pericarp adnate to or separable from the seed.

A. Small bamboos. Culms less than 1 inch diameter.

Stamens 3 1. *Arundinaria*.

B. Large bamboos. Culms over 1 inch diameter.

Stamens 6

1. Culms with the lower branches thorny or culm-sheaths with large fringed auricles ... 2. *Bambusa*.

2. Culms without thorny branches. Culm-sheaths without large fringed auricles ... 3. *Dendrocalamus*.

1. ARUNDINARIA, Michaux. (*The Ringals*.)

Erect, rarely climbing, shrub-like bamboos, usually tufted and growing gregariously. Culms slender, nodes prominent, branches fasciculate. Culm-sheaths thin, early deciduous; imperfect blade narrow. Leaves usually small. Inflorescence paniculate or racemose, terminal on leafy or on separate culms. Spikelets 1-many-flowered, compressed; flowers mostly bisexual; empty glumes 2, membranous, unequal; flowering glume longer, concave, many-nerved; palea usually shorter than the flowering glume. Lodicules 3, ciliate. Stamens 3-6, usually 3. Ovary often hairy; style short. Pericarp adnate to the seed.

I.—Culms crowded into definite clumps.

1. Transverse veins conspicuous. Leaf-sheath
bristly at the tip 1. *spathiflora*.

2. Transverse veins nil or very obscure. Leaf-sheath not bristly at the tip.

(a) Nodes without a distinct pale ring. Culm-sheath gradually narrowed from the middle. Bracts less than 1 inch long 2. *falcata*.

(b) Nodes with a distinct pale ring. Culm-sheath narrowed only at the top. Bracts up to 2 inches long 3. *Falconeri*.

II.—Culms arising singly from a creeping rhizome not forming definite clumps. Transverse veins conspicuous. Leaf-sheath bristly at the tip 4. *jaunsarensis*.

Note.—Transverse veins when described as conspicuous are visible to the naked eye when the blade is held up to the light. When described as obscure they are not visible even with an ordinary hand lens as a rule.

1. *Arundinaria spathiflora*, Trin. Vern. *Parikh* or *Thām*, G.—Culms crowded into clumps, usually 12—20 feet long and 6—8 inch diameter, when young greenish sometimes tinged with purple and always with a whitish bloom, dark green when old with an incrustation formed from the bloom. Internodes 10—16 inches long. Culm-sheaths one-to two-thirds the length of the internodes, edges parallel to near the apex, then narrowed to a truncately rounded tip 5 inch broad; imperfect blade 1—4 inches long, subulate. Leaves 2.5—5.5 by 4—6 inch, 2—4 at the ends of the twigs, transverse veins conspicuous dividing the leaf into numerous rectangles. Leaf-sheath loose, persistent, ciliate on one edge, bearing at the top short auricles furnished with a few long purple bristles; ligule ciliate. Inflorescence usually on separate leafless culms, consisting of fascicled drooping paniced racemes subtended by large papery bracts 2-3 inches long. Spikelets 1.2-5 inches long, 4—8—flowered. Stigmas 3.

Occurs throughout the central and inner ranges between 8,000 and 11,000 feet. Gregarious and very common. Usually associated with *Quercus semecarpifolia* and sometimes with *Abies Pindrow*.

2. *Arundinaria falcata*, Nees. Vern. *Gadh-ningāl* or *Gola-ningāl*, G.—Culms crowded into clumps, usually 6—12 feet long and 4.5 inch diameter, green and smooth covered with a conspicuous whitish bloom when young, yellowish when old. Internodes 6—10 inches long. Culm-sheaths as long as or up to 2 inches longer than the internodes, gradually narrowed from the middle to a truncate tip; imperfect blade 5—2 inches long, subulate. Leaves 3-4 by 2.3 inch sometimes up to 12 by 1 inch on young shoots, transverse veins very obscure. Leaf-sheath glabrous; ligule membranous, dentate or lacerate. Inflorescence on separate leafless culms, consisting of falcate paniced racemes subtended by short linear or lanceolate bracts less than 1 inch long. Spikelets 5—7 inch long, 2-sometimes 1-flowered, some sessile; others on long slender pedicels. Stigmas 2.

Occurs throughout the hills between 4,000 and 8,500 feet. Gregarious and very common, usually associated with *Quercus incana*. I have measured a culm of this species 22 feet long and .8 inch diameter. It flowered gregariously in Garhwal in 1916.

3. *Arundinaria Falconeri*, Benth. Vern. *Deo-ningal*, G.—Culms crowded into clumps, usually 6—12 feet long, covered with a glaucous bloom when young, yellow when old with an incrustation formed from the bloom, the nodes usually with a conspicuous whitish ring. Internodes 6—10 inches long. Culm-sheaths varying from less than the length of one internode to the length of two internodes, oblong, narrowed only at the top to a truncate tip; imperfect blade 1—4 inches long, subulate. Leaves 2—5 at the ends of the twigs, 3—6 by .5—.75 inch, transverse veins absent. Leaf-sheath glabrous with ciliate margins; ligule long, hairy. Inflorescence on separate leafless culms, consisting of fascicled panicked racemes subtended by papery bracts .75—2 inches long. Spikelets 1-flowered.

Occurs throughout the central and inner ranges between 6,500 and 8,500 feet. Gregarious and common though less common than any of the other species of ringal. It flowered gregariously in 1913 and 1914 in Garhwal.

4. *Arundinaria jaunsarensis*, Gamble. Vern. *Jumra*, *Gyons* or *Sarura*, G.—Culms arising singly from a creeping rhizome, not forming definite clumps, usually 8—16 feet long and .5—.75 inch diameter, when young covered with a glaucous bloom, smooth and yellowish-green when old. Internodes 7—15 inches long. Culm-sheaths usually two thirds the length of the internode, rarely exceeding it, broad at the base, edges nearly parallel in the lower half, narrowed at the top to a truncate tip, glabrous, terminating in two auricles bearing stiff bristles; imperfect blade 1—4 inches long, subulate. Leaves 2—5 at the ends of the twigs, 4—6 by .5—.75 inch, transverse veins conspicuous dividing the leaf into numerous rectangles. Leaf-sheath persistent, bearing at the top short falcate auricles furnished with 5-6 stiff bristles; ligule pubescent.

Occurs throughout the central and inner ranges between 7,000 and 10,500 feet. Very common and gregarious, most frequent in association with *Quercus semecarpifolia*, but also with *Abies Pindrow* and *Quercus dilatata*. I have measured a culm up to 22 feet long.

2. BAMBUA, Schreb.

Erect bamboos growing in dense or rather open clumps. Culms small to large. Culm-sheaths various, often with very large fringed crimped auricles. Leaves with inconspicuous transverse veins. Inflorescence a large compound panicle. Spikelets 1- many -flowered; empty glumes 1—4; flowering glumes ovate-lanceolate usually mucronate; palea 2-keeled, the keels ciliate or not. Lodicules 3, ciliate. Stamens 6. Ovary hairy above; stigmas 1—3. Pericarp thin, adnate to the seed.

Bambusa arundinacea, Willd. Vern. *Kānta bāns*, Gen. *Kanwās*, H. Eng. Thorny Bamboo.—Culms 4—60 feet high and 4—7 inches diameter, bright green, in very congested clumps with numerous stiff leafless branches near the base which bear strong curved thorns. Nodes very prominent; internodes 12—18 inches long, the walls 1-2 inches thick. Culm-sheaths 9—12 inches long, striate, orange-yellow and thickly ciliate with golden hair when young otherwise glabrous, rounded at the top; imperfect blade triangular, sharply pointed, concave with involute margins, densely felted within with dark bristly hairs, the margins decurrent on the sheath, wavy, plaited, long and thickly ciliated but hardly auricled. Leaves seldom exceeding 8 by 7 inch, secondary longitudinal nerves 4—6 on either side of the midrib. Spikelets 5—1 inch long, glabrous; empty glumes 0 or 1-2; flowers 3—7, the lower bisexual, the upper male, followed by 1—3 imperfect flowers.

This bamboo is not generally supposed to be indigenous in the Ganges valley. Without going so far as to definitely contradict this belief I must nevertheless record that in my opinion this species has every appearance of being both wild and indigenous in the Haldwani Division. Here it is found in abundance east of the Nandhaur river where it commonly forms a fringe along the banks of *tarai* streams, and it is apparently as common in the most remote and unfrequented forests as in those which might be expected to have come in contact with present or past civilisations. In other divisions this bamboo is rarely seen and then only where planted. This species flowered gregariously throughout the subhimalayan tract in April, 1926.

3. DENDROCALAMUS, Nees.

Erect unarmed bamboos, usually growing in dense clumps. Culms medium-sized or large. Culm-sheaths often very large, imperfect blade narrow-triangular. Leaves without transverse veins. Inflorescence a large compound panicle. Spikelets few-flowered, usually in globose heads; flowers usually bisexual; empty glumes 2-3, many-nerved; flowering glumes like the empty; palea of lower flowers keeled, of upper dorsally rounded. Lodicules 0 or rare. Stamens 6. Ovary hairy above. Stigma usually simple. Pericarp coriaceous or crustaceous, separable from the seed.

Culms 1—4 inches diameter. Leaves rarely over 1 inch wide. Spikelets spinescent, yellowish 1. *strictus*.

Culms 4—7 inches diameter. Leaves over 1 inch wide. Spikelets soft, purple 2. *Hamiltonii*.

1. **Dendrocalamus strictus**, Nees. Vern. *Bāns*, Gen.—Culms densely tufted, 20—40 feet high and 1—4 inches diameter, glaucous and covered with white scurf when young, often solid or nearly so near the base. Internodes 10—15 inches long. Culm-sheaths a little shorter than the internodes, glabrous or with blackish stiff hairs, striate, rounded at the top, ciliate at the edges, very slightly auricled; imperfect blade elongate-triangular, hairy especially within. Leaves 1—10 by

2—1.2 inches. Leaf-sheaths striate, hairy, ending in a prominent callus and short auricles with a few deciduous cilia. Spikelets spinescent, in dense globular heads which are 1.5—4 inches apart and 1—1.5 inches diameter. Stamens yellow.

Occurs throughout the subhimalayan tract and outer hill ranges between 1,000 and 5,000 feet. Abundant and gregarious throughout the Bhabar. Flowers gregariously at long intervals but sporadic flowering also takes place every year. Flowers: March-April. Fruit: June.

2. *Dendrocalamus Hamiltonii*, Nees. and Arn.—Culms fairly densely tufted, 40—60 feet high and 4—7 inches diameter, greyish-white when young with dense adpressed pubescence, dull green when old, usually naked below, often with very long branches arising singly from the upper nodes, nodes towards the base of the culms often with small abortive rootlets. Internodes 12—20 inches long, walls .5 inch thick. Culm-sheath as long as the internodes or shorter, stiff, persistent, glabrous or with scanty patches of brown stiff adpressed hairs without, truncate at the top and furnished on either side with small glabrous triangular auricles; imperfect blade often 12 inches long, narrowly ovate-lanceolate, about three-fourths as broad at the base as the top of the culm-sheath, glabrous without but with black sharp hairs at the base within. Leaves 2—18 by .5—4 inches. Leaf-sheath with a prominent shining callus at the apex. Spikelets soft, in semi-globular heads which are 2 inches or less apart and .7—1.5 inches diameter. Stamens purple.

Apparently not indigenous within our area but is sometimes cultivated at elevations up to 2,500 feet, and Mr. W. J. Lambert informs me that it is found naturalised in the Haldwani Division below the Punagiri temple. There are no specimens of this bamboo from our area at either the Kew or Dehra Dun herbaria. It is one of the common bamboos of Sikkim.

XCII.—GNETACEÆ.

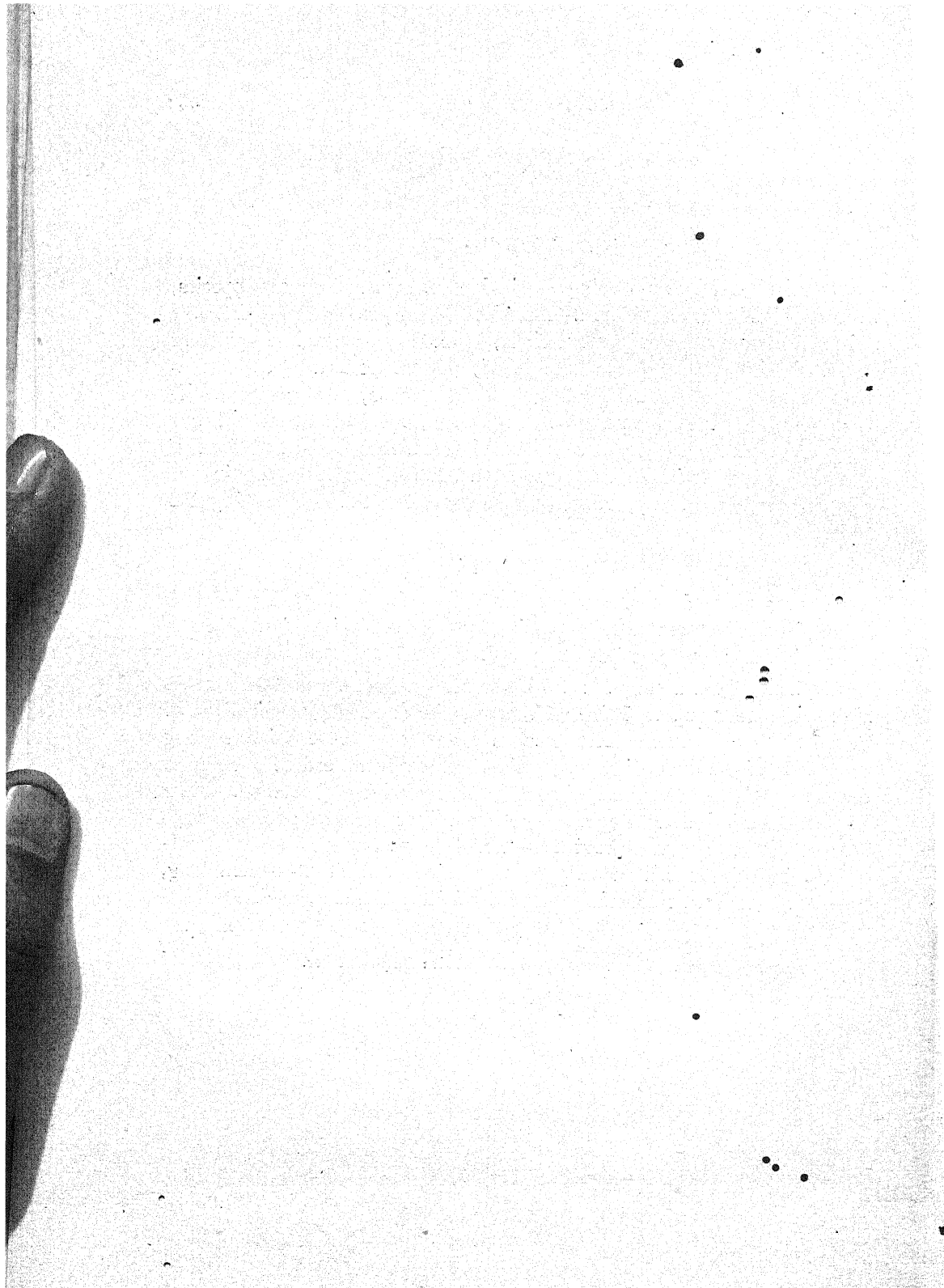
Shrubs, erect or climbing, resin-ducts absent. Leaves opposite, whorled or reduced to a short 2—4-toothed sheath, exstipulate. Flowers unisexual, dioecious, rarely monœcious, in axillary or terminal spikes or cones. Male flowers; perianth 2-lobed, valvate or spathaceous; filaments connate in a column; anthers 2—8, globose, 1—3-celled, sessile or subsessile on the column. Female flowers; one erect ovule with one integument prolonged into a tube (tubillus) which has the functions of a style, and enclosed in a single or double perianth. Fruit (in the following species) fleshy, consisting of succulent bracts enclosing 1-2 seeds.

EPHEDRA, *Linn.*

•Leaves reduced to sheaths at the nodes of the branches. Male flowers in short bracteate spikes which are whorled or in pairs. Female flowers in pairs, or sometimes 3 or solitary.

***Ephedra Gerardiana*, Wall.**—A low dense tufted shrub 6—18 inches high with stems up to 1 inch diameter. Bark rough, reddish-brown. Branchlets green, erect, often curved. Internodes .5—1.5 inches long by about .05—.1 inch diameter, striate. Leaves reduced to sheaths at the nodes of the branches. Sheaths .08 inch long, 2-toothed. Male flowers 4—8, in bracteate spikes which are solitary or 2-3 together; bracts rotund, obtuse, connate, about .05—.1 inch long; anthers 5—8. Female flowers in 1-2-flowered, usually solitary spikes. Fruit .3-.4 inch long, ovoid, red, succulent containing a sticky juice. Seeds 2, black.

Occurs along the main Himalayan range between 6,500 and 14,000 feet. Very common on the inner dry ranges bordering Tibet where it grows on open exposed shingly slopes or amongst rocks. Flowers: May—July. Fruit: July—October.



XCIII.—TAXACEÆ.

Trees or shrubs. No vessels in secondary wood. Leaves mostly narrow, linear or lanceolate. Flowers diclinous. Perianth 0. Pollen-sacs born on the undersurface of sporophylls (stamens) which are usually scale-like. Carpels (sporophylls) solitary or few. Fruit drupaceous; seed exserted.

TAXUS, *Tourn.*

A tree with many varieties. Flowers usually dioecious. Leaves bifarious, linear. Male flower a pedicelled whorl of 3—8 pollen-sacs on a peltate sporophyll. Female flower reduced to a single ovule, terminating a short peduncle clothed with imbricating scales, and seated on a thick cup-shaped disk, enlarged in fruit.

• ***Taxus baccata*, Linn.** Vern. *Thunër*, Gen. Eng. Yew.—A small evergreen tree up to 12 feet girth and 40 feet high, but usually smaller. Stems branched low down and usually irregularly fluted. Bark dark reddish-brown, rough, exfoliating in irregular thin, often papery scales. Blaze 3—35 inch, soft and somewhat fibrous, pink. Leaves 1—1.5 inches long, linear, flattened, distichous, acute, narrowed into a short petiole which is decurrent along the twig, dark green and shining above, pale yellowish or rusty beneath. Male flowers in catkins which are subglobose and solitary in the leaf-axils. Stamens about 10. Female flowers solitary, axillary, resembling leaf-buds. Fruit composed of the enlarged cup-shaped disk which ultimately becomes succulent and bright red, about .3 inch long, and surrounds the olive-green seed of which only the tip is exposed.

Occurs throughout the hills between 6,000 and 11,000 feet. Scarce in the central and outer ranges, common on the inner ranges on north aspects in forests of *Quercus semicarpifolia*, *Picea Morinda* and *Abies Pindrow*. Flowers: April-May. Fruit: November.



XCIV.—PINACEÆ.

Trees or shrubs, mostly evergreen. Leaves usually needle-like or scale-like, always containing resin-canals. Flowers diclinous. Perianth 0. Male flowers in deciduous catkins consisting of numerous sporophylls (stamens) which are usually scale-like and bear 2—6, rarely more, 1-celled pollen-sacs on the lower surface. Female flowers in cones consisting of numerous scale-like open carpels (sporophylls) which are flat or peltate and bear either directly or on a special subsidiary scale (placental scale) 1-many ovules. Fruit usually a woody cone sometimes berry-like. Seeds not exserted.

I.—Cones more or less woody when ripe.

A. Cones falling off entire.

1. Leaves needle-like.

(a) Leaves in bundles of 3 or 5 ... 1. *Pinus*.

(b) Leaves single.

* Leaves 4-sided, spreading in all directions ... 2. *Picea*.

** Leaves flat, more or less distichous ... 3. *Tsuga*.

2. Leaves scale-like ... 4. *Cupressus*.

B. Cones breaking up on ripening.

1. Leaves flattened, more or less distichous ... 5. *Abies*.

2. Leaves triquetrous, fascicled on dwarf shoots,
single and spirally arranged on long shoots ... 6. *Cedrus*.

II.—Cones more or less succulent when ripe forming a
berry-like fruit ... 7. *Juniperus*.

1. *PINUS*, Linn. (*The Pines*.)

Evergreen trees, the branches whorled. Shoots dimorphic, long shoots and dwarf shoots. Leaves dimorphic, those of seedlings and long shoots single, needle-like or reduced to scales, those of dwarf shoots arranged in bundles of 2, 3 or 5, dwarf shoots shed with their leaves. Flowers monoecious. Catkins borne on the shoots of the current year, in whorls crowded at the base of the shoots. Stamens numerous, each bearing 2 pollen-sacs, the connective produced in a membranous tip. Cones solitary or whorled; scales double, the lower (carpellary) small disappearing in fruit, the upper (placental) bearing near its base 2 reversed ovules and becoming hard and woody in fruit. Ripe cone formed from the imbricating placental scales. Seed usually winged.

Leaves in bundles of 3. Cone of thick woody scales ... 1. *longifolia*.

Leaves in bundles of 5. Cone of slightly woody scales ... 2. *excelsa*.

Dr. Brandis in his Forest Flora gives Dr. Jameson as his authority for stating that *Pinus Gerardiana*. Wall. occurs between Malari and Bampa in the Niti valley and this

statement has apparently been copied by subsequent authors though J. L. Stewart in his Punjab Plants says that the dried specimens from this area at Saharanpur hardly agree with *P. Gerardiana*. I was twice in this locality and failed to discover any pine except *P. excelsa* through I made a close search and I feel convinced therefore that *P. Gerardiana* does not occur. This pine has a smooth bark with leaves 2—4 inches long in bundles of 3.

1. *Pinus longifolia*, Roxb. Vern. *Chir*, Gen. *Salla*, NG and EA. *Kolain*, NG.—A large evergreen tree commonly attaining 8 feet girth and 120 feet high. Bark of poles and immature trees grey or pinkish-brown, very rough and deeply fissured longitudinally; of fully mature stems fairly smooth split up by a network of shallow cracks into irregular scales. Leaves in bundles of 3, 9—12 inches long, bright green, each bundle surrounded at the base by a persistent sheath of bud-scales 5—1 inch long. Catkins 5 inch long. Cones on short stiff stalks; solitary or 2—5 together. Ripe cones 4—8 inches long, 3—5 inches diameter; scales very thick and woody with a pyramidal pointed or recurved beak. Seed 3 inch long with a long thin membranous wing.

Occurs throughout the hills between 1,500 and 8,000 feet, but not found in the dry interior ranges. Forms extensive forests which are remarkable for the general absence of other tree species, though *Quercus incana* is a frequent associate at higher elevations. At Gwaldam in north Garhwal I have measured a tree 14.5 feet girth and 150 feet high. Flowers: March-April. Cones ripen January—June.

2. *Pinus excelsa*, Wall. Vern. *Chilla* or *Safed-chailu*, NG. *Dhurasala*, EA. Eng. Blue Pine.—A large evergreen tree commonly attaining 7 feet girth and 100 feet high. Bark of poles quite smooth and greenish-grey; of older stems pale grey and rough with vertical cracks; of fully mature stems pinkish-grey or pinkish-brown split up by a network of deep or shallow fissures into irregular scales usually about 2-3 inches across and 6—9 inches high. Leaves in bundles of 5, 4—8 inches long, bluish or greyish-green, slender, drooping; sheath of bud-scales deciduous. Catkins 3 inch long. Cones at the ends of the shoots, usually 2-3 together. Ripe cones 6—12 inches long, cylindric; scales only slightly woody with obtuse tips. Seeds 3 inch long, wing 3 times the length of the seed.

Occurs wild along the main Himalayan range between 4,500 and 12,500 feet. Extensively introduced in plantations in other parts of the hills, but not indigenous. Abundant on the dry inner ranges where it often occurs pure as a belt immediately below that of *Betula utilis*; here it attains its maximum elevation. South of the main range it occurs more locally and is usually found associated with *Quercus incana*, *Picea Morinda* and *Cupressus torulosa*; here its range extends from 4,500 to 8,500 feet. I have measured trees in North Garhwal of 12 feet girth and 90 feet high, also of 7 feet girth and 140 feet high. Flowers: April—June. Cones ripen September—November.

2. PICEA, Link. (*The Spruces*.)

Large evergreen trees, the branches whorled. Shoots not dimorphic, only long shoots present. Leaves scattered, spiral, 4-angled in section, acute, jointed at the base. Cones pendulous; scales persistent, divided into carpellary and placental, placental scales with two ovules

side by side on the upper surface. Ripe cone formed from the imbricating placental scales.

Picea Morinda, Link. Syn. *P. Smithiana*, Boiss. Vern. *Rāga*, *Kathēla* or *Kala-chiulu*, NG.—A large evergreen tree commonly attaining 15 feet girth and 160 feet high, with whorled horizontal or drooping branches and hanging branchlets. Bark reddish-brown or pale grey, rough, exfoliating in thin woody plates; on very old trees split up into large polygonal or oval scales with shallow cracks between. Blaze .5—1.5 inch, fibrous, pink freckled with orange-brown. Leaves 1—1.5 inches long, spirally arranged all round the branches, needle-like, stiff and pointed. Flowers monœcious. Catkins .75—1 inch long, solitary, erect, nearly sessile in the axils of the upper leaves. Stamens with 2 linear pollen-sacs, the connective produced. Cones solitary and terminal; carpellary scales disappearing in fruit; placental scales bearing 2 reversed ovules near the base. Ripe cones 4—6 by 1.2 inches, pendulous; placental scales coriaceous. Seed .2—1.25 inch long; wing .5 inch long, obliquely spatulate.

Occurs along the main Himalayan range in North Garhwal between 6,000 and 11,000 feet, but I have no record of its occurrence in the Almora district. It is found in Garhwal on both sides of the main range and almost invariably on north aspects. Occasionally it forms pure forest, but is more usually mixed with *Abies Pindrow* or deciduous broad leaved trees. In the Nandagiri valley I have measured a tree 17 feet girth and 205 feet high and near Ganoi in Dasoli a tree of 21 feet girth at breast height. Flowers: April. Cones ripen October-November.

3. TSUGA, Carrière. (*The Hemlock Spruces*.)

Evergreen trees. Shoots not dimorphic, only long shoots present. Leaves scattered, spiral, flat, narrow, jointed on the branch. Cones small, pendulous; scales persistent, divided into carpellary and placental, placental scales with two ovules side by side on the upper surface.

Tsuga Brunoniana, Carr. Vern. *Tansin*, Bhotia. *Rāghi* or *Patri*, EA.—A large evergreen tree up to 15 feet girth and 120 feet high. Branchlets pendulous. Young shoots pubescent. Leaves .5—1 inch long, more or less distichous, whitish beneath, tip obtuse, base narrowed to a very short petiole. Petiole jointed to a decurrent raised rib on the branchlets. Flowers monœcious. Catkins .1—1.2 inch long, pedunculate, axillary and terminal. Stamens with 2 rounded pollen-sacs. Peduncles slender, .05—1.5 inch long, surrounded at the base by a cluster of scales. Cones solitary and terminal, .4—1.5 inch long; placental scales bearing 2 reversed ovules at the base. Ripe cones .7—1 inch long, ovoid; scales rounded, coriaceous, persistent. Seeds .3—1.35 inch long; wing oblong, obtuse.

Occurs on the main Himalayan range along the Darma and upper Kali valleys of East Almora between 8,000 and 10,000 feet. Common. This is believed to be the most westerly extension of this species. Flowers: May-June. Cones ripen the same year.

4. CUPRESSUS, Linn. (*The Cypresses.*)

Evergreen trees, branches whorled or not. Leaves; of seedlings and young plants needle-like, in whorls of 3 or 4, spreading; of older plants scale-like, densely covering the shoots, the tips spreading or closely adpressed, opposite in pairs. Flowers monœcious. Catkins numerous, solitary at the tips of the branchlets, ovoid, small; stamens stipitate, peltate, bearing at their lower edge 2—6 globose pollen-sacs. Cones composed of 4—12 decussate, peltate scales, those at the base and apex sterile, the others bearing 2-many ovules. Ripe cone globose, woody, composed of the peltate scales which touch one another at the edges, but do not overlap. Seeds compressed or angular with lateral wings.

Cupressus torulosa, Don. Vern. *Surai*, G. *Sirai*, A.—A large evergreen tree commonly attaining 12 feet girth and 150 feet high, with rather short horizontal or drooping branches forming an almost cylindric crown. Bark pale or dark brown often reddish, rough with large fairly deep vertical fissures usually 1-2 inches apart, exfoliating in fibrous strips. Blaze .5—1.5 inches, pink, fibrous. Leaves of old plants .1 inch long or less, triangular, thick, with closely adpressed tips so that the branches are not rough to the touch, closely imbricated on the youngest twigs. Catkins .2-.3 inch long, often tinged purple, solitary at the tips of the branchlets. Cones globose; scales 6—10. Ripe cones .5—.7 inch diameter; scales woody. Seeds compressed, about .2 inch across the wings.

Occurs throughout the hills between 6,000 and 9,500 feet either wild or planted. On the main Himalayan range it is common either in pure forest or associated with other species, principally *Quercus dilatata*, *Pinus excelsa* and *Picea Morinda*. On the southern slopes of this range it is found almost exclusively on limestone. In the Kulgari Gadh, Nawali Reserve of North Garhwal I measured a tree 17 feet girth and 205 feet high, whilst in 1915 an apparently sound tree close to Bumial Deota, Durmi, Dasoli, in North Garhwal measured 26 feet girth at breast height and 145 feet to where the top had been broken off. Flowers: January-February. Fruit: October-November.

5. ABIES, Juss. (*The Silver Firs.*)

Tall evergreen trees. Shoots not dimorphic, only long shoots present. Leaves spiral, needle-like, usually flattened. Cones erect, scales thin, breaking away from a persistent woody axis when ripe, the carpellary scales smaller than the placental but occasionally longer and projecting between them; placental scales bearing at the base 2 reversed ovules.

Young shoots glabrous. Leaves up to 4 inches long, distichous

- | | | | | |
|---|-----|-----|-----|---------------------|
| ... | ... | ... | ... | 1. <i>Pindrow.</i> |
| Young shoots hairy. Leaves up to 2 inches long, spreading | ... | ... | ... | 2. <i>Webbiana.</i> |
| in all directions except below | ... | ... | ... | |

1. *Abies Pindrow*, Spach. Vern. *Rāga*, Gen. *Ransula*, SG. *Dodimma*, *Chilla*, *Childi* and *Jhilla*, NG. *Raisol*, EA. Eng. Low-level Silver Fir.—A large evergreen tree commonly attaining 10 feet girth and 140 feet high with a narrow cylindric crown of horizontal or drooping branches. Bark dark grey or brown, rough, becoming more or less deeply furrowed with maturity, exfoliating in irregular woody scales. Blaze .75—1 inch, somewhat fibrous, uniform deep reddish-brown or purplish-red. Young shoots glabrous. Leaves .5—4 inches long, distichous, those above much smaller than those below, flattened, lower surface with two pale glaucous bands on either side of the raised midrib, glossy dark green above with depressed midrib, the tip notched. Flowers monœcious. Catkins .5—7 inch long, clustered. Stamens with 2 linear pollen-sacs; connective produced. Cones solitary or in distant pairs, erect, situated a little below the tips of the shoots, dark blue or purple. Ripe cones erect, cylindric, 4—7 by 1.5—3 inches; scales crustaceous. Seed .4-.5 inch long, wing longer than the seed.

Occurs throughout the central and inner ranges between 7,000 and 10,500 feet and is also represented in the outer ranges by a small outlier to the east of Naini Tal. Abundant on the slopes of the main Himalayan range, usually on north aspects. It is found both pure and mixed with *Quercus semecarpifolia* or spruce. In the forest above Gulabkoti in North Garhwal I have measured a tree 16 feet girth at breast height and 175 feet high. Flowers: April-May. Cones ripen September—November.

2. *Abies Webbiana*, Lindl. (Vernacular names similar to those given for *A. Pindrow*).—A tree very similar to and perhaps not specifically distinct from *A. Pindrow*. It is however found at higher elevations, namely 8,500 to 12,500 feet and is confined to the main Himalayan range where it is abundant and usually associated with either *Betula utilis* or *Quercus semecarpifolia*, especially the former. I have twice found the two firs growing side by side, but this is exceptional. It is usually mature at 5 feet girth and 80 feet high though I have measured a tree of 12 feet girth and 105 feet high. The bark is often blackish and less deeply fissured than in *A. Pindrow*. The young shoots are hairy. The leaves are .5—2 inches long and spread out from the shoots in all directions except beneath. The cones are shorter and thicker than in *A. Pindrow*.

6. CEDRUS, Loud. (*The Cedars*.)

Large evergreen trees. Shoots dimorphic, long shoots and dwarf shoots. Leaves spiral, triquetrous, acicular, jointed near the base. Cones erect, scales deciduous, divided into carpellary and placental, placental scales with two ovules side by side on the upper surface.

Cedrus Deodara, Loudon. Vern. *Deodār*, Gen.—A large evergreen tree commonly attaining 10 feet girth and 100 feet high. Bark

dark brown often reddish, old stems with a network of deep furrows separated by woody ridges. Blaze 1.5—2 inches, pinkish-brown. Long shoots with the needles solitary and arranged spirally, dwarf shoots with the needles arranged in dense whorls. Leaves 1—1.5 inches long. Flowers usually monœcious. Catkins solitary at the ends of the branchlets, cylindric, 1—1.75 inches long; stamens with 2 oblong pollen-sacs, the connective produced as a flattened appendage. Cones solitary at the ends of the branchlets; placental scales large, carpellary small, the former bearing 2 reversed ovules near the base. Ripe cones erect, 4-5 by 3-4 inches; placental scales woody breaking away from the stout woody axis. Seed .3—6 inch long; wing longer than the seed.

Only truly indigenous in the north of Garhwal which was till recently considered the eastern limit of this species. However Mr. J. V. Collier has now recorded its occurrence at the head of the Kurnauli valley in Nepal, *vide* the Indian Forester for February, 1924. North of the main Himalayan range in North Garhwal it occurs plentifully between 8,000 and 11,000 feet either pure or mixed with blue pine and spruce. South of the main range it is very scarce and is found usually mixed with cypress between 6,500 and 8,000 feet. It has been introduced with varying success in all hill Divisions. I have measured a tree near Pandukeshwar 14 feet girth and 170 feet high and another close to Ganoi village in Dasoli 30 feet girth at breast height. Flowers: September-October. Cones ripen October-November of the following year.

7. JUNIPERUS, Linn. (*The Junipers.*)

Evergreen shrubs or small trees, aromatic. Leaves often glandular on the back, needle-like in whorls of 3; or scale-like, opposite, in pairs or threes; on young plants and vigorous shoots subulate, spreading. Flowers monœcious or dicecious. Catkins small, cylindric, ovoid, axillary or terminal, solitary; stamens decussate or in threes, connective enlarged, ovate or peltate at the apex, bearing 2—6 globose pollen-sacs near the base. Cones composed of 2—6 opposite or ternate scales, the scales usually not all fertile; ovules 1-2 to each fertile scale, upright. Fruit a berry-like cone, more or less succulent, smooth or marked by the tips of the scales. Seeds not winged.

I.—Leaves in whorls of 3, ascending or spreading, the tip not adpressed, lower surface glaucous concave.

- | | |
|--|----------------------|
| 1. Flowers axillary. Leaves .2—5 inch long. | |
| Cones 1—3-seeded | 1. <i>communis</i> . |
| 2. Flowers terminal. Leaves .1-.2 inch long. | |
| Cone 1-seeded | 2. <i>recurva</i> . |

II.—Leaves of two kinds; normally on branches of mature plants thick, scale-like, decussate, the tip closely adpressed. Flowers terminal.

- | | |
|--|---------------------------|
| 1. An erect tree. Foliage open, pale and somewhat glaucous. Cone 2—5-seeded ... | 3. <i>macropoda</i> . |
| 2. A procumbent shrub. Foliage dense, dark green and not glaucous. Cone 1-seeded ... | 4. <i>pseudo-sabina</i> . |

• 1. *Juniperus communis*, Linn. Vern. *Jhora*, NG.—An evergreen shrub with procumbent spreading stems not rising more than 24

inches above the ground. Leaves 2—5 inch long, in whorls of 3, linear, sharply pointed, spreading nearly at right angles to the branchlets, convex on the back, concave and glaucous beneath, jointed at the base and continued down the stem with a large gland on the decurrent portion. Flowers dioecious, axillary. Fruit 3-4 inch long, subglobose, blue-black, glaucous, the tips of the scales visible at the apex. Seeds 1—3.

Occurs on the dry inner ranges bordering Tibet between 9,000 and 14,000 feet. Rather scarce. It is found in exposed open positions often in company with other members of the genus. Flowers: April-May. Fruit: October of the second year.

2. *Juniperus recurva*, Buch.-Ham.—An evergreen shrub with procumbent stems up to 2 inches diameter which curve upwards at the tips rising 2—4 feet above the ground. Leaves 1-2 inch long, in whorls of 3, lanceolate, sharply pointed, ascending, loosely imbricated, somewhat incurved, back convex, lower surface concave and somewhat glaucous, base not jointed, decurrent with a large gland on the decurrent portion which is often produced along the back of the free portion. Flowers dioecious, terminal or terminating short lateral branchlets. Fruit 3-4 inch long, ovoid, black. Seed 1.

Occurs along the main Himalayan range on both its northern and southern slopes between 10,000 and 12,500 feet. Rather scarce. This is I believed the only juniper found on the southern slopes where the rainfall is heavy. It is found on open steep hillsides. In the absence of flowers or fruit this species might be mistaken for a small-leaved *J. communis*, but whereas in *J. communis* the foliage is very prickly when grasped in the hand this is not the case with *J. recurva*. Flowers: June-July. Fruit: November of the second year.

3. *Juniperus macropoda*, Boiss. Vern. Padmār or Padmāk, NG.—A small evergreen tree up to 9 feet girth and 30 feet high with a rapidly tapering stem. Bark light brown or pale grey, very rough, exfoliating in coarse fibrous strips. Blaze white. Foliage pale somewhat glaucous green. Leaves of two kinds; on young seedlings and some of the lower branches subulate, pointed; on most branches scale-like, .05—15 inch long, closely adpressed, with a large oblong or elliptic gland in the centre of the back. Flowers monœcious, the male at the tips of the branchlets, the female terminating short side branchlets. Fruit 3 inch diameter, globose, blue-black with a faint glaucous bloom, the tips of the scales forming transverse ridges. Seeds 2—5.

Occurs on the dry inner ranges bordering Tibet between 8,500 and 12,000 feet. Not uncommon round Malari and is also found at Milam but its distribution appears to be very localised. It has a gregarious tendency and forms open forest on exposed south slopes either pure or in company with *deodar* and blue pine. Flowers: May-June. Fruit: October.

4. *Juniperus pseudo-sabina*, Fisch. and Mey. Vern. Bitāru or Chapq-bitāru, NG. *Pumār*, NA.—An evergreen shrub with procumbent stems up to 6 inches diameter which arch upwards rising as a rule 1—3 feet above the ground, but occasionally up to 6 feet high. Bark at first reddish-brown turning grey, very rough, exfoliating in coarse

fibrous strips. Foliage dark green, not glaucous. Leaves of two kinds; on young seedlings vigorous long shoots and some of the lower branches, flattened, more or less spreading, with sharp tips; on most branches scale-like, closely adpressed, the backs obtusely keeled, so that the branchlets are more or less quadrangular; gland narrow-linear, not very conspicuous. Flowers dioecious, terminating short or very short lateral branchlets. Fruit .3 inch long, ovoid, blue when ripe. Seed 1.

Occurs on the dry inner ranges bordering Tibet between 9,000 and 14,500 feet. The commonest juniper of this tract and often abundant, though in places nearly exterminated for fuel. Each plant when mature covers as a rule an area of several square yards. It is somewhat gregarious, but individual plants are always scattered. It grows on open often rocky ground. Flowers: May-June. Fruit: July—September.

ABBREVIATIONS.

In recording vernacular names, the localities or Forest Divisions where such are in use have been abbreviated as follows :—

NG = North Garhwal Division.

SG = South Garhwal Division.

RK = Ranikhet Division.

CA = Central Almora Division.

EA = East Almora Division.

NT = Naini Tal Division.

HD = All the above six hill Divisions.

G = Garhwal District.

A = Almora District.

L = Lansdowne Division.

K = Kalagarh Division.

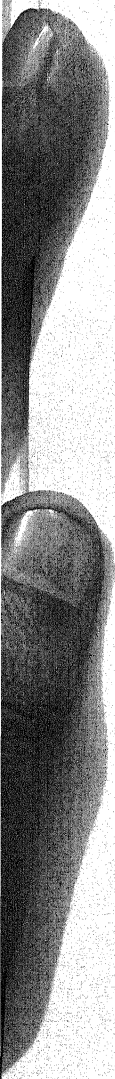
R = Ramnagar Division.

H = Haldwani Division.

BD = All the above four Bhabar Divisions.

All = All Divisions, hill and Bhabar.

Gen = Used to show wide distribution.



GLOSSARY OF BOTANIC TERMS

(including the meanings of some specific names).

A

- Abortive**, imperfectly developed.
Acaulis, without a stem.
Acicular, slender or needle shaped.
Accrescent, said of parts of the calyx or corolla, that persist and increase in size after flowering.
Aculeate, armed with prickles.
Acuminate, tapering to an **acumen**, or sharp point.
Adelphous, a term used in compounds with a numeral, e.g., stamens monadelphous, meaning that the stamens are united into one bundle or tube.
Adherent, said of dissimilar parts when united but separable without laceration.
Adhate, said of the union of dissimilar parts.
Adpressed, lying close against throughout the whole length as hairs lying along a stem or against the surface of a leaf.
Adventitious, said of organs arising in an unusual position.
Alatus, winged.
Albiflorus, with white flowers.
Albuminous, said of seeds having **albumen** or nutritive substance often found surrounding the embryo.
Alternate, said of leaves placed singly on the stem, one at each node.
Amplexicaul, clasping the stem.
Anastomose, to join up like the fine veins in a leaf, so as to form a net.
Anatropous, said of an ovule having the micropyle next the hilum and the part where the seed coats unite with the nucleus at the apex.
Androgynophore, a stalk or stipe elevating both the stamens and the pistil of a flower.
Androgynous, said of an inflorescence which bears both male and female flowers.
Angustifolius, narrow-leaved.
Annular, disposed in a ring.
Antheriferous, bearing anthers.
Anterior, said of the portion of an axillary flower that faces outwards from the axis of inflorescence.
Aphyllous, without leaves.
Apiculate, having an **apiculus** or short-pointed tip.
Apocarpous, having the carpels separate from each other.
Arborescent, tree-like in size or appearance.

Arboreus, tree-like.**Arcuate**, curved like a bow.**Areolate**, divided up into or marked with areoles or small spaces clearly outlined.*Argutus*, sharp, pointed.**Aril**, **arillus**, an accessory seed-covering produced after fertilisation and arising from the placenta or funicle.**Aristate**, bearing an awn or bristle.**Armed**, having spines, thorns or prickles.**Articulated**, jointed.**Ascending**, directed obliquely upwards.**Asexual**, having neither male nor female organs.*Asper*, rough.**Atro-**, in compounds, blackish.**Attenuate**, narrow and gradually tapering**Auricle**, an appendage like the lobe of the ear.**Auriculate**, having auricles.*Australis*, southern.**Awn**, a bristle-like appendage.**Axil**, the upper angle between a leaf and its stem or twig.**Axile**, said of placenta attached to the inner angles of the cells of a compound ovary.**Axillary**, in or relating to an axil.

B

Baccate, berry-like; pulpy throughout.*Bacillaris*, used for making walking sticks.*Barbatus*, bearded.**Basal**, attached to or arising from the base.**Basifixed**, said of an anther with connate cells attached at the lower end to the top of the filament.*Bellus*, pretty, handsome.**Bi-** (in compounds) two, twice, doubly.**Bilabiate**, two-lipped, a term applied to some gamopetalous flowers, the upper lip usually of two united petals, the lower of three.**Bisexual**, said of flowers which have stamens and pistil in the same flower.*Bombycinus*, silky.*Brachystachyum*, with short spikes.**Bulb**, a leaf-bud usually underground, composed of a short fleshy axis enclosed in fleshy scales, e.g., onion.**Bulbil**, a small bulb usually applied to those which arise in the axils of the leaves of *Dioscorea*, or on the inflorescence of *Agave*.

C

- Caducous**, falling off early;
Casius, bluish-grey.
Cæspitose, growing in tufts.
Callose, bearing leathery or thickened hard parts.
Callus, a hard projection.
Calycine, pertaining to or resembling the calyx.
Calyculus, a minute whorl of bracts below the calyx. resembling an additional calyx.
Calyptra, a cap or hood; **Calyptrate**, hooded.
Campanulate, bell-shaped.
Candidus, pure white.
Canescent, covered with very short pubescence giving the surface a greyish white hue.
Canus, hoary, grey.
Capitate, head-shaped or collected into a head; dim. **Capitellate**.
Capreolate, bearing tendrils.
Capsular, like a capsule or dry dehiscent seed vessel composed of more than one carpel.
Carneus, flesh-coloured.
Carpophyll, a leaf which functions as a carpel.
Cartilaginous, hard and tough, as the skin of an apple-pip.
Caryopsis, a one-seeded fruit with the pericarp adherent to the seed.
Catkin, a deciduous spike of unisexual flowers.
Caudate, tailed.
Cauline, pertaining to the stem.
Cernuus, nodding.
Chlorophyll, the green colouring-matter of plants.
Cilia, thick marginal hairs forming a fringe; **Ciliate**, having cilia; dim. **Cilliolate**.
Cinereous, ash-coloured.
Circinate, coiled inward from the tip like the young frond of a fern.
Circumsciss, dividing or opening circularly or transversely, as a capsule opening by a lid.
Cirrhus, a tendril; **Cirrhose**, bearing tendrils.
Cladode, a flattened branch which assumes the form and function of a leaf.
Clavate, club-shaped.
Claw, the narrowed base of certain petals.
Coccineus, scarlet.
Coherent, said of similar parts when united but separable without laceration.
Collateral, placed side by side.
Coma, a tuft of soft hairs, especially those of a seed.
- Comose**, furnished with a tuft of long soft hairs.
Concinnus, neat or elegant.
Conduplicate, folded together lengthwise.
Connate, said of the union of similar parts.
Connective, that portion of the stamen which unites the two lobes of the anther.
Conniving, or **Connivent**, having the parts or organs arching over or converging at the apex.
Contorted, twisted in one direction upon itself; with one margin of each leaf within and the other margin without the coil.
Convolute, contorted (only in aestivation).
Cordate, heart-shaped.
Coriaceous, leathery, thick and tough.
Corm, a bulb-like fleshy stem or base of a stem.
Cornutus, horned or spurred.
Corolline, pertaining to or resembling the corolla.
Corona, a whorl of outgrowths from the stamens or corolla.
Corymb, an inflorescence which has the lower flower stalks longer than the upper, so as to bring all the flowers to about the same level; **Corymbose**, in corymbs or having the character of corymbs.
Costate, ribbed.
Crassicaulis, thick-stemmed.
Crenate, with rounded teeth; dim. **Crenulate**.
Crenatures, the minute notches of a crenate leaf.
Cristate, crested.
Crustaceous, hard and brittle.
Calm, the characteristic hollow jointed stem of grasses.
Cuneate, wedge-shaped.
Cupular, cup-shaped.
Cuspidate, tapering to a cusp or long rig'd point.
Cyathiform, wine-cup-shaped.
Cyme, an inflorescence in which the main axis and all the lateral axes are each terminated by a flower and the flowering proceeds outwards and downwards; **Cymese**, in cymes or having the character of cymes.
Cystolith, a cell containing crystalline concretions of calcium carbonate.

D

- Declinate**, bent to one side or downward.
Decomound, said of a compound leaf the divisions and sub-divisions of which are also compound.

Decumbent, inclined downwards but with the tip ascending.
Decurrent, applied to leaves when the blade is produced down the stem as a wing or ridge.
Decussate, said of leaves arranged on the stem in pairs, each pair being at right angles to the pairs above and below it.
Definite, limited as to number, shape or character. Applied to stamens when they are not more than about 23.
Dehisce, to open at maturity so as to discharge the contents; *n.* **Dehiscence**.
Deitold, triangular in outline.
Dentate, toothed, with the margin cut into triangular teeth directed outwards, not forward or backward; *dim.* **Denticulate**.
Dextorse, twining towards the right (of climbers).
Di, Dis (prefix), two, twice, double.
Dichasium, a false dichotomy in which two lateral shoots of nearly equal strength arise from the primary axis below the flower which terminates the axis, the process being repeated by each set of branches.
Dichotomous, forked in pairs.
Diclinous, having the stamens in one flower and the pistil in another.
Didymous, slightly two-lobed or found in pairs.
Didynamous, having two long and two short stamens.
Diffuse, widely or loosely spreading.
Digitate, applied to a compound leaf when the leaflets are borne on the apex of the petiole.
Dilatatus, widened.
Dimorphous, occurring in two forms. Usually applied to bisexual flowers, some having long stamens and short style, others short stamens and long style.
Dioecious, unisexual with the male and female flowers on separate plants.
Disarticulate, to break off at a joint or break up into pieces at joints.
Discoid, disk-like, flat and circular.
Disk, a development of the receptacle of a flower as a cushion, cup, ring or glands; the central portion of the flower heads in Composite.
Dissepiment, the partition of an ovary consisting of the contiguous faces of two carpels, when otherwise formed as by an outgrowth from the dorsal suture or from the placenta, it is said to be false or epurious.
Distal, furthest from the base.
Distichous, arranged in two opposite rows, both rows being in the same plane.

Divaricate, spreading widely apart.
Dorsal, relating to or attached to the back.
Dorsifixed, said of an anther attached to the top of the filament by a part, not the whole of the back.
Drupaceous, resembling or relating to a drupe.
Drupelet, a diminutive drupe.
Dulcis, agreeable to the sight or taste.
Dumetorum, relating to thickets.

E

E, *ex*, without, out of (as a prefix).
Eburneous, ivory-white.
Echinate, covered with sharp prickles or bristles, like a hedge-hog.
Elatus, lofty.
Elegans, elegant.
Emarginate, notched at the apex.
Endocarp, the inner layer of the pericarp.
Ensiform, sword-shaped.
Epi, upon (as a prefix).
Epicarp, the outer layer of pericarp when composed of three layers, *viz.*, *epi*-, *meso*-, and *endocarp*.
Epigynous, growing upon or inserted on the top of the ovary.
Epiphyte, a plant growing upon, but not nourished by, another plant.
Eriocarpus, with a woolly fruit.
Erubescens, blush-red.
Estrophiolate, having no strophiole, or appendage at the hilum.
Exalbuminous, without albumen, the food material of the seed being stored in the embryo itself.
Excelsus, tall.
Exilis, thin, lank and straight.
Exocarp, the outer layer of the pericarp when there are only two-layers, *viz.*, *exo*- and *endo*-carp.
Exserted, protruded beyond, as stamens beyond the tube of the corolla.
Extorse, turned or opening outwards.

F

Falcate, sickle-shaped.
Fascicle, a close or dense cluster.
Fastigate, applied to branches which are nearly parallel and point upward.
Farious, used in compounds with a numeral, *e.g.*, **bifarious**, in two opposite rows.
Ferous (in compounds), bearing.
Ferruginous, the colour of iron rust.
Fid, cut at the margin but not very deeply. Used in compounds, *e.g.*, **palmitid**.
Filamentose, thread-like.
Filiform, thread-like.

Fimbriate, having a fringe or border of fine thread-like processes.

Fistular, hollow, tubular.

Flabellate, or **Flabelliform**, fan-shaped.

Flaccid, soft, wanting in stiffness.

Flavus, yellow; **Flavidus**, yellowish.

Flexuous, wavy, zig-zag.

Floribundus, bearing flowers in abundance.

Follicle, a fruit of a single carpel dehiscing by one suture only, usually the ventral.

Formosus, beautiful.

Foveolatus, marked with small pitting.

Fragrans, sweet-scented.

Frondosus, leafy.

Fruticosus, shrubby.

Fugacious, falling off or fading very early.

Fulgid, shining.

Fulvous, tawny.

Funicle, the thread or stalk connecting the ovule or seed with the placenta.

Furcate, forked.

Fuscous, dark-coloured, greyish-brown.

Fusiform, spindle-shaped, tapering at both ends and somewhat bulging at the centre.

G

Gamopetalous, with united petals.

Geminate, in pairs.

Genitalia, the sexual organs, stamens and pistil.

Gibbous, having a pouch-like swelling on one side.

Glabrous, without hairs or down.

Glabrate, **Glabrescent**, becoming glabrous or nearly so.

Gland, a swelling or excrescence of the surface, dry or secreting oil or resin: an oil vesicle in the epidermis or in leaves, flowers or fruit: a lobe of the flower-disk.

Glaucous, bluish-grey or bluish-green;

Glaucouscent, somewhat glaucous.

Globose, somewhat spherical.

Glochidia, barbed bristles.

Glomerate, compactly clustered.

Glume, one of the chaff-like bracts found in the flowers of grasses and sedges.

Glutinous, sticky.

Gracilis, slender.

Grandiflorus, with large flowers.

Gratus, pleasing, agreeable.

Graveolens, with a strong somewhat unpleasant odour.

Gregarious, growing or tending to grow in groups of the same species.

Gynophore, an elongation of the receptacle forming a stipe to the pistil.

H

Hamate or **Hamose**, with the end curved or hooked.

Hastate, spear-head-shaped.

Haustorium, a root-like sucker, the sucker at the end of a parasitic root.

Hebepetalus, with pubescent petals.

Heterogamous, when male, female, bisexual and neuter florets or any two or three of these are borne in the same flower-head.

Hilum, the point of attachment of an ovule to the funicle; the scar left on the seed by its separation from the funicle.

Hirsute, covered with long and somewhat stiff hairs.

Hispid, covered with long stiff bristly hairs.

Hoary, canescent, grey from fine pubescence.

Homogamous, with the florets of a flower head alike in sex.

Hortensis, growing in gardens.

Humilis, low in stature.

Hyaline, colourless and transparent.

Hypanthium, an enlargement or development of the torus under the calyx or perianth.

Hypocrateriform, salver-shaped; said of a corolla with slender cylindric tube and flat horizontally expanded limb.

Hypogynous, inserted below the ovary.

Hypoleucus, applied to leaves with the lower surface white.

I

Imbricate, overlapping.

Imparipinnate, pinnate with a terminal leaflet.

Incanus, grey or hoary.

Incised, cut sharply and irregularly; **Incis-serrate**, deeply serrate.

Included, not protruded beyond the surrounding organ, i.e., stamens when included within the corolla or its tube.

Incumbent, leaning upon.

Indefinite, too many to be readily counted

Induplicate, with the margins folded inward.

Indurated, hardened.

Integerrima, quite entire.

Intergrifolius, with entire or simple leaves.

Inferior, situated below:—**ovary**, one wholly adnate to the calyx-tube or nearly so.

Inflorescence, the arrangement of flowers on an axis; the axis with all the flowers it bears.

Insignis, remarkable.

Inter- (prefix), between.

Interfloral, said of a palm-spadix which flowers while the leaf in whose axil it is formed is still green.

Interpetiolar, between the petioles.

Intra-(prefix), within.

Intrapetiolar, within the petiole or between it and the stem.

Introrse, turned or opening inward.

Involucre, **Involucrum**, a whorl of bracts surrounding several flowers; **Involucrate**, having an involucre.

Involute, rolled inward.

Irregular flower, one in which the petals or perianth segments are unequal in size or shape or inserted at unequal distances.

Isonomous, having an equal number of members.

J

Juliflora, with catkin-like inflorescence.

K

Keel (in a papilionaceous flower), the two anterior petals which are usually more or less united.

L

Lacerate, irregularly cleft as if torn.

Laciniate, irregularly cut into narrow segments, fringed with narrow lobes.

Lacunose, marked with minute pits or depressions.

Lævigata, smooth as if polished.

Lævis, smooth.

Lagopus, lit, hare-footed, hence densely covered with long hair.

Lamella, a thin plate.

Lanate, woolly.

Lanceolate, shaped like a lance head; narrowly ovate and tapering to both ends.

Lanuginose, woolly or cottony, finer than lanate.

Lappaceus, bur-like.

Lasiocarpus, with pubescent fruit.

Latex, milky-juice.

Latifolius, with broad leaves.

Left (twisted to the—, overlapping to the—, twining to the left) from right to left as viewed from outside in front of the coil or plant or flower bud.

Legume, a pod. A fruit from a single carpel opening by both sutures when ripe.

Lenticellate, bearing lenticels or corky spots on the bark.

Lenticularis, like a double convex lense.

Lepidote, covered with scurfy scales.

Ligulate, strap-shaped.

Ligule, the strap-shaped ray florets in many Composite; a scarious projection from the leaf-sheath of grasses at the junction of the blade; an outgrowth from the inner face of certain petals.

Limb, the expanded portion of a gamopetalous flower or the blade of a clawed petal or of a leaf.

Linear, several times longer than wide with nearly parallel edges.

Lineolate, marked with fine lines.

Lip, one of the two divisions of a bilabiate calyx or corolla.

Lobulate, having minute lobes.

Locellus, a secondary division of a cell;

Locellate, said of an ovary of one cell divided into two locelli or compartments.

Loculicidal, a form of dehiscence of a ripe carpel, the split being down the dorsal suture, i.e., into the cell and not between the cells.

Loculus, the cell of an ovary.

Lodicules, minute scales at the base of the ovary of grasses representing the perianth.

Lucidus, bright, clear, with a shining surface.

M

Macro-(prefix), large.

Mammillate, having granular teat-like prominences.

Marcescent, withering without falling off. *Maritimus*, belonging to the sea, confined to the sea-coast.

Mesocarp, the middle layer of the pericarp.

Micro-(prefix), small.

Mitiform, shaped like an abbot's mitre.

Mollis, soft, tender, flexible.

Mon-, monoc-(prefix), one, alone, single.

Moniliform, like a necklace, cylindric and contracted at intervals.

Monœcious, having the stamens and pistil in separate flowers on the same plant.

Montana, inhabiting mountainous regions.

Moschatus, having the odour of musk.

Mucro, a short, straight, stiff, abrupt point; **Mucronate**, tipped with a mucro.

Muricate, rough with short sharp points.

Muticus, blunt.

N

Nanus, dwarf.

Nemoralis, growing in groves.

Nervosus, with many or prominent nerves.

Nitidus, shining.

Niveus, snowy white.

Nodose, knotty or knobby (chiefly of roots).

Nutans, nodding.

O

- Ob-** (prefix), reversed or inverted; *e.g.*,
Obconic, shaped like an inverted cone.
Obdiplostemonous, having twice as many stamens as petals in two whorls, those of the outer whorl being inserted opposite the petals.
Odoratus, sweet-smelling.
Officinalis, used in medicine or procurable in shops.
Oid (suffix and in compounds), resembling, like.
Operculum, a lid.
Opposite, said of leaves found in pairs at the nodes one on either side of the stem.
Orientalis, eastern.
Ovate, shaped like an egg in elevation with the broader part at the base.
Oxy- (prefix), sharp, sour.

P

- Pachy-** (prefix), thick.
Palea, the inner glume of the flowers of grasses.
Pallens, pale in colour.
Pallidus, somewhat pale.
Palmate, having the ribs of the leaf-lobes or leaflets all meeting at the apex of the petiole, the segments like the extended fingers of a hand.
Palminerved, **Palmiveined**, having ribs divergent from the point of insertion of the leaf.
Panicle, a loose compound inflorescence with usually the main axis racemose, the secondary and tertiary axes racemose or not.
Papillose, having minute nipple-like projections.
Pappus, the ring of hairs or scales at the apex of the fruit in *Compositae*.
Papyraceus, papery, hence suitable for paper-making.
Parietal, said of placentae attached to the wall of the cells of a compound ovary.
Paripinnate, pinnate with an even number of leaflets, *i.e.*, with no terminal one.
Partite, divided but not quite to the base.
Parviflora, with small flowers.
Patent, widely spreading.
Patulus, standing open, somewhat spreading.
Pectinate, with close narrow segments like the teeth of a comb.
Pedate, palmately divided with the lateral segments two-cleft.
Pedical, the ultimate stalk supporting a single flower of an inflorescence;
Pedicellate, having a pedicel.
- Peduncle**, the stalk of a flower or of a cluster of flowers; **Pedunculate**, having a peduncle.
Pellucid, transparent or translucent.
Peltate, shield-shaped; said of a flat body, as a leaf, attached to the stalk by the lower surface and not by the margin or base.
Penicellate, bordered or tipped with brush-like hairs.
Penninerved, **Penniveined**, having the lateral nerves of the leaf running straight from the midrib to the margin.
Penta-, (in compounds) five.
Pentamerous, said of the flower when there are five members in each whorl.
Perianth, the floral envelopes, calyx or corolla or both: a term mainly used when there is little or no difference in size and appearance between the sepals and petals.
Pericarp, the ripened ovary with its constituent parts, consisting sometimes of two layers (exocarp and endocarp) or three (epi-, meso- and endo-carp).
Perigynous, inserted around and away from the ovary.
Persicum, a peach.
Petaloid, resembling petals.
Petiole, the stalk of a leaf; *adj.* **Petiolate**.
Petiolule, the stalk of a leaflet: *adj.* **Petiolulate**.
Phyllocladum, a branch modified to resemble a leaf in form and function.
Phyllodium, a petiole having the form and function of a leaf, the blade being abortive.
Pictus, marked with colour as though painted.
Pilose, thinly hairy with long soft simple hairs.
Pinna, the primary division of a compound leaf when itself divided into leaflets.
Pinnate, said of a compound leaf with leaflets or pinnae arranged on either side of the rachis.
Pinnule, the secondary division of a compound leaf when itself divided into leaflets.
Pisiform, pea-shaped.
Pistillode, the abortive ovary in male flowers.
Placenta, the place or process in the ovary on which the ovules are borne.
Platyphyllus, having broad leaves.
Plicate, folded lengthwise like a fan.
Plumose, with branches disposed like the plume on the shaft of a feather.
Polygamous, with bisexual and unisexual flowers borne by the same species on one or on different individuals.
Polystachya, having many spikes.

Pome, a fruit like an apple; a succulent inferior many-celled fruit the seeds in dry cells with tough and hard lining; a drupe with cartilaginous endocarp.

Posterior, said of the portion of an axillary flower that faces towards the axis of inflorescence.

Precatorius, used for a rosary.

Prickle, a sharp pointed outgrowth of the epidermis.

Procerus, very tall.

Procumbent, lying for the whole or greater part of its length along or close to the ground.

Protandrous, said of a flower when the stamens mature before the stigma.

Proximal, nearest the base or starting point.

Pruinose, covered with waxy bloom or powder.

Pseud-, pseudo- (prefix), false.

Puberulous, with very short soft hairs or down.

Pubescent, with soft hairs or down.

Pulchellus, beautiful.

Pulverulentus, powdered as if dusted.

Pulvinate, cushion-shaped.

Pumilus, low in stature.

Punctate, dotted with small glands.

Pungens, lit, piercing, hence bristly or spinous.

Pustular, having slight elevations like blisters.

Putamen, the hard bony endocarp of a drupe; the stone of a stone-fruit.

Pygmaeus, dwarf.

Pyrene, one of the small stones in a drupe.

Pyriform, pear-shaped.

Q

Quadrata, square.

Quinate, 5-nate, with the parts of the flower in fives.

R

Raceme, a form of inflorescence in which the flowering axis is long and undivided and the flowers arranged on either side are on equal or nearly equal pedicels; **Racemose**, in racemes or having the character of racemes.

Rachis, the prolongation of the petiole in a pinnate leaf or the prolongation of the peduncle of an inflorescence. Often loosely used to include the petiole or peduncle as the case may be.

Radical, relating to or springing from the root.

Ray, one of the radiating branches of an umbel; **Ray florets**, the flowers borne on the circumference of the heads in Compositæ.

Ramosissimus, very much branched.

Receptacle the portion of the axis of a flower that bears the sepals, petals stamens and pistil; the short axis bearing the flowers in Compositæ.

Regular, when the parts of each whorl in a flower are alike.

Reniform, kidney-shaped.

Repand, with a slightly-uneven margin; not quite sinuate.

Repens, prostrate and rooting.

Reticulation, the net-work made by the veins in many leaves; **Reticulate**, having veins in the form of a net-work.

Retinaculum, the hook-like funicle of many of the Acanthaceæ.

Retorse, directed backward or downward.

Retuse, having a shallow notch in a rounded apex.

Revolute, having the margin or apex of the leaf rolled back upon the under-face.

Rhizome, a root-stock or stem of root-like appearance, prostrate or underground.

Right, (twisted to the—, overlapping to the—, twining to the right). From left to right as viewed from outside in front of the coil or plant or flower bud.

Riparius, growing by rivers or streams.

Robustus, strong, sturdy.

Rostrate, beaked.

Rosulate, collected in a rosette; said of leaves when radical and arranged in a circle on or close to the ground.

Rotata, wheel-shaped; said of a regular gamopetalous corolla with short tube and flat spreading limb.

Rubicaulis, with a stem like a bramble.

Rubricaulis, with red stems.

Rugose, wrinkled; dim. **Rugulose**.

Ruminata, marked by transverse lines or divisions like the albumen of the seed of the nutmeg.

Rupicola, dwelling among rocks.

S

Saccate, swollen like a little bag, as the short spur of some petals.

Sagittate, shaped like the head of an arrow, i.e., with two pointed downward directed basal lobes.

Samara, a dry indehiscent winged fruit.

Sanguineus, blood-red.

Sapidus, having a pleasant taste.

Sarmentose, bearing long slender branches or runners.

Scabrid, roughish, somewhat sabrous.
Scabrous, rough to the touch.
Scandent, climbing.
Scarious, dry, thin and membranous and not green.
Schizocarp, a general name for a dry fruit which on maturity splits into one-seeded portions.
Sclerotic, hardened or stony in texture.
Scorpid, said of a form of unilateral inflorescence which is coiled inward from apex to base when young.
Sebiferus, producing vegetable wax.
Sect, completely divided from margin to midrib into distinct parts.
Second, said when parts or organs are all turned to the same side of the supporting axis.
Semi (in compounds), half.
Sempervirens, evergreen.
Separius, found growing in hedges.
Septicidal, a form of dehiscence of a ripe carpel, the split being through the dissepiments or lines of junction of the carpels.
Septum, any kind of partition whether a dissepiment or not.
Seriate, arranged in rows either transverse or longitudinal.
Sericeous, clothed with silky adpressed hairs.
Serrate, toothed like a saw with teeth directed forward; dim. **Serrulate**.
Sessile, without a stalk.
Seta, a bristle; **Setiform**, **Setaceous**, bristle-like; **Setula**, a minute bristle; **Setulose**, bearing minute bristles.
Sinenensis, indigenous to China.
Sinistorse, twining towards the left (of climbers).
Sinuate, having a strongly wavy margin which (in the case of a leaf) bends inwards and outwards in the plane of the leaf, not up and down.
Sinus, the space between the lobes of a leaf, a recess or re-entering angle.
Spadix, an inflorescence with sessile flowers on a thick fleshy axis usually enclosed in one or more sheathing bracts; the inflorescence of palms so called because enclosed in a spathe before full development.
Spathe, a large membranous sheath-like bract enclosing a flower-cluster.
Spathulate, oblong with the basal end attenuated.
Speciosus, beautiful.
Spike, an inflorescence having a long undivided axis and sessile flowers;
Spicate, arranged in spikes; **Spiciform**, spike-like.

Spikelet, a secondary spike; usually applied to the grasses in which one or more flowers are subtended by a common pair of glumes.
Spinous, **Spinose**, bearing spines, spine-like; **Spinescent**, ending in a sharp spine-like point, spine-like.
Sporadic, scattered, the opposite of gregarious.
Standard, the large posterior petal of a papilionaceous flower.
Stenocarpus narrow-pointed.
Stigmatose, relating to the stigma.
Stipe, a stalk or stalk like support; **Stipitate** having a stipe, usually applied to an ovary carpel or gland, never to leaves, flowers or inflorescences.
Stipel, an appendage to a leaflet analogous to the stipule of a leaf; **Stipellate**, furnished with stipels.
Stipule, an appendage at the base of a leaf; **Stipulate**, furnished with stipules;
Stipular, occupying the place of stipules.
Striate, marked with striae, i.e., minute furrows.
Strictus, close or narrow and upright, very straight.
Strobiliform, like a fir-cone.
Strophiolate, having a strophiale, or appendage at the hilum.
Suaveolens, sweet-scented.
Sub (prefix), somewhat, almost or under.
Suberosus, corky.
Subulate, awl-shaped.
Suffrutescent, low somewhat woody and branching near the ground; **Suffrutescens**, forming an under-shrub.
Sulcate, grooved or furrowed.
Superior, situated above; - **ovary**, one free from or inserted above the calyx.
Suture, a seam indicating the line of union of two parts.
Sylvestris, growing in woods.
Syncarpium, a fruit formed by the union of several carpels which have become compacted and fleshy.
Syncarpous, having united carpels.

T

Tenuis, thin, narrow.
Terete, cylindrical, round in cross-section.
Ternate, three in a whorl or cluster.
Tessellated, divided up into small squares.
Testa, the outermost coat of the seed.
Tetra (in compounds), four.
Tetramerous, said of the flower when there are four members in each whorl.
Thyrsoïd, resembling a thyrsum.
Thyrsum, a contracted or ovate panicle.
Tingens, used in dyeing.

Tomantose, densely covered with short soft tangled hairs; **Tomentum**, a covering of tomentose hairs.

Torulose, cylindric with slight contractions at intervals.

Torus, the axis of a flower on which the floral organs are inserted. Syn. **receptacle**.

• **Tri-** (in compounds), three.

Tribuloïdes, beset with sharp bristles, echinate.

Trichophyllus, with hairy leaves.

Trichotomous, divided with the divisions in threes.

Trigonus, three-angled.

Trijuga, with 3 pairs of pinnæ.

Trimerous, said of the flower when there are three members in each whorl.

Triquetrous, three angled with the edges or faces concave, rendering the angles salient.

Truncate, ending abruptly as if the end had been cut off.

Tuber, the thickened portion of an underground stem.

• **Tubillus**, the integument of an ovule prolonged into a tube having the functions of a style.

Tumid, swollen.

Turbinate, top-shaped, like a broad inverted cone.

Turgid, swollen, distended.

Twisted, (in aestivation), with one margin of each petal within and the other without the coil. See **right** and **left**.

U

Uliginosus, growing in swamps.

Umbel, a form of inflorescence in which the pedicels radiate from the top of a common peduncle and are all of the same length.

Umbilicus, the hilum of a seed.

Umbonate, bearing a boss or conical protuberance.

Umbrosus, growing in shady places.

Undulate, wavy, with a wavy margin which (in the case of a leaf) bends up and down at right angles to the plane of the leaf.

Unilateral, arranged on one side of the axis.

Unisexual, having the stamens in one and the pistil in another flower.

Urceolate, urn-shaped, tubular but contracted at or below the mouth.

Utilis, useful.

Utricle, a one-celled, one-seeded fruit with a thin, somewhat loose pericarp.

V

Vaginatus, having a sheathing leaf base.

Valvate, with the margins of the members of a whorl exactly meeting without overlapping.

Velutinus, velvety, densely covered with short soft straight silky hairs.

Ventral, relating or attached to the front or inner angle of a carpel.

Ventricosus, bulging or swollen on one side: dim. **Ventriculose**,

Venulosus, profusely veined.

Verrucose, covered with wart-like excrescences.

Versatile, said of an anther attached by a point on the back to the apex of the filament so as to turn or swing readily.

Verticillate, whorled.

Vestitus, clothed, hence more or less densely clothed with hairs.

Vexillary, pertaining to or nearest to the standard in a papilionaceous flower.

Villosus, covered with long soft hairs.

Vimineus, with long flexible twigs.

Volubilis, twining.

W

Whorl, a circle of organs in the transverse plane around an axis.

Wings, the side petals of a papilionaceous flower.

X

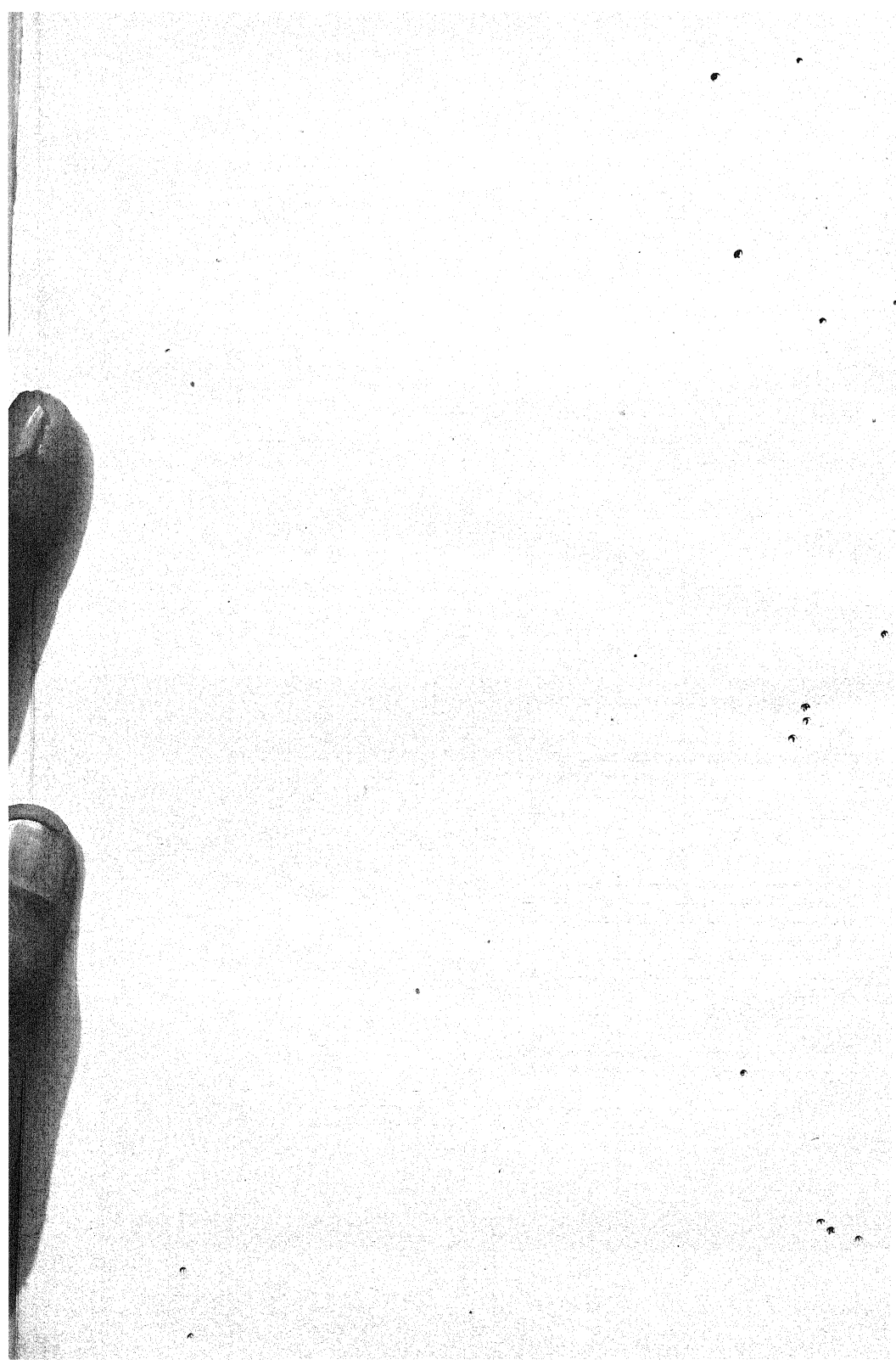
Xantho- (in compounds) yellow.

Xerophytic, said of plants that grow naturally in dry hot places.

Z

Zeylanicus, indigenous to Ceylon.

Zygomorphic, capable of being bisected into similar halves by only one plane, bilaterally symmetrical.



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